THE

SILVA OF NORTH AMERICA

BY

CHARLES SPRAGUE SARGENT

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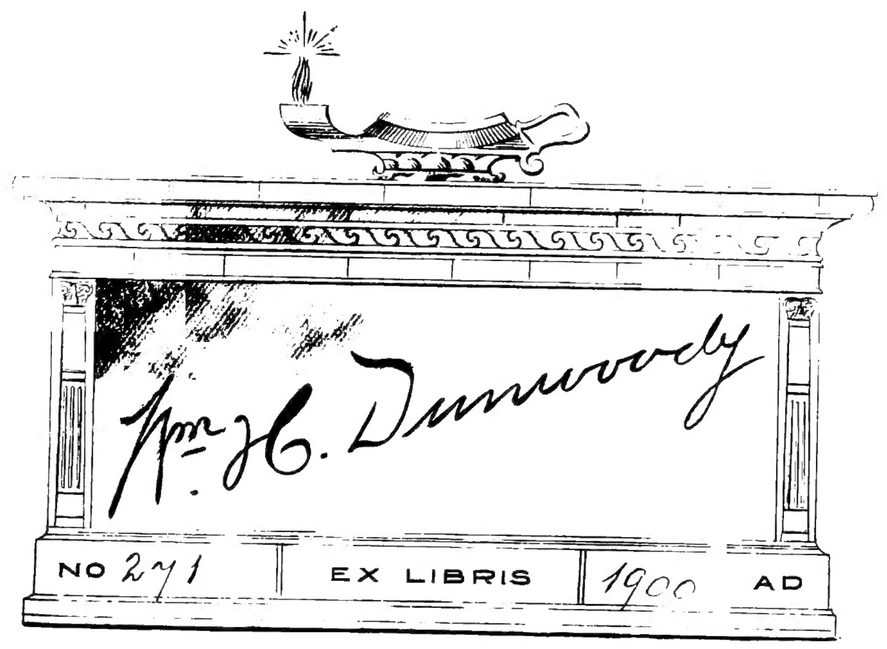

THE

SILVA OF NORTH AMERICA

A DESCRIPTION OF THE TREES WHICH GROW NATURALLY IN NORTH AMERICA EXCLUSIVE OF MEXICO

BY

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OF HARVARD UNIVERSITY

Illustrated with Figures and Analyses drawn from Nature

BY

CHARLES EDWARD FAXON

VOLUME VII

LAURACEÆ—JUGLANDACEÆ

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To

SIR JOSEPH DALTON HOOKER,

WHOSE LABORS HAVE LARGELY INCREASED KNOWLEDGE

IN REGARD TO TREES OF THREE CONTINENTS

AND WHOSE EXAMPLE

HAS BEEN A STIMULANT TO BOTANICAL STUDY IN EVERY LAND,

THIS SEVENTH VOLUME OF

THE SILVA OF NORTH AMERICA

IS GRATEFULLY DEDICATED

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SYNOPSIS OF THE ORDERS OF PLANTS CONTAINED IN VOLUME VII. OF THE SILVA OF NORTH AMERICA.

CLASS I. **DICOTYLEDONOUS or EXOGENOUS PLANTS.**

Stems increasing in diameter by the annual addition of a layer of wood inside the bark. Leaves netted-veined. Embryo with a pair of opposite cotyledons.

SUB-CLASS I. **Angiospermæ.** Pistil, a closed ovary containing the ovules and developing into the fruit.

DIVISION III. **Apetalæ.** Corolla 0. Stamens inserted on the petaloid calyx, or hypogynous.

44. **Lauraceæ.** Flowers perfect or diœcious. Stamens 9 to 12, hypogynous. Ovary superior, 1-celled. Ovule solitary, suspended, anatropous. Seed exalbuminous. Leaves alternate or opposite, exstipulate.

45. **Euphorbiaceæ.** Flowers unisexual. Stamens 1, few or many. Ovary superior, usually 1-celled. Ovule solitary, or 2, collateral, descending, anatropous. Seed albuminous. Leaves usually alternate or opposite, stipulate.

46. **Ulmaceæ.** Flowers perfect or polygamo-monœcious. Stamens as many as the lobes of the calyx, hypogynous. Ovary superior, 1-celled. Ovule solitary, suspended, anatropous. Fruit a compressed winged samara, or drupaceous. Seed albuminous. Leaves alternate, stipulate.

47. **Moraceæ.** Flowers unisexual. Stamens as many as the lobes of the calyx. Ovary superior, 1-celled. Ovule solitary, suspended, anatropous. Seed albuminous. Leaves alternate or opposite, stipulate.

48. **Platanaceæ.** Flowers monœcious in dense unisexual capitate heads. Stamens as many as the lobes of the calyx. Ovary superior, 1-celled. Ovule usually solitary, suspended, orthotropous. Seed albuminous. Leaves alternate, stipulate.

49. **Leitneriaceæ.** Flowers amentaceous, diœcious. Stamens 3 to 12. Ovary superior, 1-celled. Ovule solitary, ascending, semianatropous. Fruit drupaceous. Seed albuminous. Leaves alternate, exstipulate.

50. **Juglandaceæ.** Flowers monœcious. Stamens indefinite. Ovary inferior, 1-celled. Ovule erect, orthotropous. Fruit a nut inclosed in an indehiscent or 4-valved woody or fleshy involucre. Leaves alternate, exstipulate.

SILVA OF NORTH AMERICA.

PERSEA.

FLOWERS perfect; calyx 6-lobed, the lobes in two series, imbricated in æstivation, persistent; corolla 0; stamens 12, in four series, those of the inner series sterile; disk 0; ovary superior, 1-celled; ovule solitary, suspended. Fruit baccate. Leaves alternate, destitute of stipules, persistent.

Persea, Linnæus, *Gen.* 94 (1737). — Endlicher, *Gen.* 317. — Meisner, *Gen.* 325. — Baillon, *Hist. Pl.* ii. 469. — Bentham & Hooker, *Gen.* iii. 156 (excl. secs. *Alseodaphne*, *Phœbe*, and *Notaphœbe*). — Pax, *Engler & Prantl Pflanzenfam.* iii. pt. ii. 114 (excl. sec. *Alseodaphne*).

Laurus, Linnæus, *Gen.* ed. 2, 174 (in part) (1742). — A. L. de Jussieu, *Gen.* 80 (in part).

Menestrata, Vellozo, *Fl. Flum.* 199; *Icon.* v. t. 2 (1825).

Tamala, Rafinesque, *Sylva Tellur.* 136 (1838).

Aromatic trees or shrubs, with naked buds. Leaves alternate, scattered, penniveined, subcoriaceous, rigid, tomentose or rarely glabrous, persistent. Flowers small, greenish yellow, apetalous, cymose or rarely subumbellate in axillary or axillary and terminal pedunculate panicles. Bracts and bractlets lanceolate, acute, caducous. Calyx campanulate, divided nearly to the base into six lobes, those of the outer series shorter than those of the inner series or sometimes nearly as long, persistent under the fruit. Stamens twelve, in four series, those of the inner series and sometimes also those of the third series reduced to staminodia; filaments flattened, inserted on the base of the calyx, longer or rarely shorter than the anthers, hirsute or glabrous, those of the third series furnished near the base with two sessile or rarely stipitate glands; anthers ovate, flattened, erect, innate, four-celled, the upper cells rather larger than the lower, or those of the third series sometimes two-celled, rarely all two-celled, the cells opening from below upward by persistent lids, those of the outer series introrse or subintrorse, those of the third series extrorse or laterally dehiscent; staminodia large, cordate-sagittate, stipitate, usually bearded at the apex; pollen simple, globose, granular. Ovary sessile, subglobose, glabrous or pilose, one-celled, narrowed into a slender simple elongated style, gradually enlarged at the apex into a discoid stigma; ovule solitary, suspended from the apex of the cell, anatropous. Fruit baccate, globose, oblong or rarely pyriform, more or less fleshy, surrounded at the base by the persistent calyx. Seed globose, pendulous, destitute of albumen; testa thin and membranaceous, separable into two coats. Embryo erect; cotyledons thick and fleshy; radicle superior, turned toward the hilum, included between the cotyledons.[1]

[1] By Mez (*Jahrb. König. Bot. Gart.* v. 135 [*Lauraceæ Americanæ Monog.*]) Persea is divided into the following subgenera: —

HEMIPERSEA. Anthers of the three outer series of stamens two-celled.

HEXANTHERA. Anthers of the two outer series of stamens four-celled, those of the third series minute and sterile.

HETERANDRA. Anthers of the two outer series of stamens four-celled, those of the third series two-celled.

EUPERSEA. Anthers of the three outer series of stamens fertile, four-celled.

Of Persea, as it is now limited, about fifty species[1] are distinguished; they are confined to the New World and to the Canary Islands, where one endemic species is found.[2] In America the genus is distributed from the coast region of the southern United States, inhabited by two species, to Brazil and Chile, where, with a single species,[3] it finds its most southern home. During the tertiary epoch Persea extended to the middle plateau of North America[4] and to the western slopes of the Sierra Nevada, where, in deposits of gold-bearing gravel, traces of an immediate ancestor of one of the existing North American species has been found;[5] and several species long played their part in the miocene and pliocene forests of central Europe.[6]

The most useful species, *Persea Persea*,[7] the Avocado or Alligator Pear, produces edible fruit which is esteemed in all tropical countries; and many of the species yield hard dark-colored handsome wood valued in cabinet-making.

Persea is not seriously injured by insects or fungal diseases.[8]

The generic name, used by Theophrastus to distinguish a tree of the Orient, was transferred by Plumier[9] to one of the tropical American species and was afterward adopted by Linnæus.

[1] Humboldt, Bonpland & Kunth, *Nov. Gen. et Spec.* ii. 157. — Kunth, *Syn. Pl. Æquin.* i. 453. — C. G. Nees ab Esenbeck, *Linnæa*, viii. 49; *Syst. Laur.* 123. — Seemann, *Bot. Voy. Herald*, 193. — A. Richard, *Fl. Cub.* iii. 185. — Grisebach, *Fl. Brit. W. Ind.* 280. — Meisner, *De Candolle Prodr.* xv. pt. i. 43; *Martius Fl. Brasil.* v. pt. ii. 151. — Hemsley, *Bot. Biol. Am. Cent.* iii. 71. — Mez, *Jahrb. König. Bot. Gart.* v. 135 (*Lauraceæ Americanæ Monog.*).

[2] *Persea Indica*, Sprengel, *Syst.* ii. 268 (1825). — C. G. Nees ab Esenbeck, *Syst. Laur.* 135. — Meisner, *De Candolle Prodr. l. c.* 52.

Laurus Indica, Linnæus, *Spec.* 370 (excl. Hab. Virginia) (1753). — Willdenow, *Spec.* ii. pt. i. 480. — Buch, *Phys. Beschr. Canar. Ins.* 140. — Webb & Berthelot, *Phytogr. Canar.* sec. iii. 224, t. 204.

Laurus Teneriffæ, Poiret, *Lam. Dict.* Suppl. iii. 322 (1813).

The Persea of the Canary Islands, which is often planted as an ornamental tree in southern Europe, is one of the most valuable timber-trees of the genus; it produces the vinatico or Madeira mahogany, a hard close-grained deep-colored wood much used in cabinet-making. (See Naudin, *Manuel de l'Acclimateur*, 399.)

[3] *Persea Lingue*, C. G. Nees ab Esenbeck, *l. c.* 157 (1836); *Linnæa*, xxi. 491. — Meisner, *l. c.* 48. — Mez, *l. c.* 169.

[4] Lesquereux, *Rep. U. S. Geolog. Surv.* vi. 75, t. 28, f. 1; 76, t. 7, f. 1; viii. 53 (*Contrib. Foss. Fl. Western Territories*, i., iii.).

[5] Lesquereux, *Mem. Mus. Comp. Zoöl.* vi. pt. ii. 19 (*Fossil Plants of the Auriferous Gravel Deposit of the Sierra Nevada*).

[6] Saporta, *Origine Paléontologique des Arbres*, 222. — Zittel, *Handb. Palæontolog.* ii. 496.

[7] Cockerell, *Bull. Torrey Bot. Club.* xix. 95 (1892).

Laurus Persea, Linnæus, *Spec.* 370 (1753). — Swartz, *Obs.* 152. — Willdenow, *Spec. l. c.* — Persoon, *Syn.* i. 449. — Tussac, *Fl. Antill.* iii. 14, t. 3.

Persea gratissima, Gærtner f. *Fruct.* iii. 222, t. 221 (1805). — *Bot. Reg.* xv. t. 1258. — Sprengel, *l. c.* — *Bot. Mag.* lxxvii. t. 4580. — Grisebach, *l. c.* — Mez, *l. c.* 145.

This tree, of which several varieties are recognized (see Mez, *l. c.*), was probably indigenous in southern Mexico and Central America (A. de Candolle, *Origine des Plantes Cultivées*, 232), and possibly in eastern Peru, where it was commonly cultivated when the country was discovered by the Spaniards (Acosta, *Hist. Nat. Ind.* 256); it appears to have been carried to the West Indian islands soon after their settlement by Europeans (Browne, *Nat. Hist. Jam.* 214. — Jacquin, *Obs.* pt. i. 38), and through cultivation to have spread gradually over all the tropical regions of America, where now it often grows spontaneously. It was introduced into India about the middle of the eighteenth century, and is generally cultivated as a fruit-tree in all the tropical parts of the Old World, growing sometimes without the assistance of man (Hasskarl, *Pl. Jav. Rar.* 213. — Miquel, *Fl. Ind. Bat.* i. pt. i. 913. — Brandis, *Forest Fl. Brit. Ind.* 378. — Baker, *Fl. Maur. and Seych.* 290).

The cultivated fruit is pear-shaped, apple-shaped, or ellipsoidal, sometimes four or five inches in length, and yellow or greenish yellow often tinged with purple; it consists of a thick rather tough skin inclosing a thick firm yellow buttery substance marked by green veins, and a large oblong seed covered with a hard rough coat. The flesh, which resembles marrow in texture and somewhat in flavor, is rather insipid. Prepared with wine, sugar, and lemon-juice, or with pepper and salt, it is, however, found delicious by people who have become accustomed to its peculiar taste. Birds and other domestic animals eagerly devour alligator pears; and they are often used for fattening hogs on account of the delicate flavor they impart to the flesh. The leaves are considered balsamic and pectoral in the West Indies, and an infusion of the buds has been recommended in the treatment of syphilis and as a cure for bruises (Barham, *Hort. Amer.* 10. — Lunan, *Hort. Jam.* i. 38). Oil employed for lighting is pressed from the pulp; and from the seeds, which contain tannic acid, an indelible black ink used for marking linen is obtained (*Treasury of Botany*, ii. 867).

Of the popular names of this tree and of its fruit, Alligator Pear has no sense or meaning; Avocado or Avocat is believed to be a corruption of the Mexican Ahuaca or Aguacata.

[8] Few of the species of fungi found on Persea in North America are confined to that genus, and none of them cause serious diseases. *Hypoxylon Sassafras*, Schweinitz, and *Nummularia microplaca*, Cooke, have been recorded on *Persea Borbonia*, as well as on Sassafras, but appear to be less common on the former than on the latter. The leaves are sometimes attacked by two spot diseases caused by *Phyllosticta micropunctata*, Cooke, and *Cercospora purpurea*, Cooke.

[9] *Nov. Pl. Am. Gen.* 44, t. 20.

CONSPECTUS OF THE NORTH AMERICAN ARBORESCENT SPECIES.

EUPERSEA. Anthers of the four exterior ranks of stamens fertile, 4-celled.

Peduncles short; leaves oblong or oblong-lanceolate, obscurely veined, glabrous; branchlets puberulous — 1. P. BORBONIA.

Peduncles elongated; leaves oval or lanceolate, conspicuously veined, tomentose on the lower surface; branchlets coated with tomentum . . . . . — 2. P. PUBESCENS.

PERSEA BORBONIA.

Red Bay.

LEAVES oblong or oblong-lanceolate, obscurely veined, glabrous. Branchlets puberulous.

Persea Borbonia, Sprengel, *Syst.* ii. 268 (1825). — Coulter, *Contrib. U. S. Nat. Herb.* ii. 383 (*Man. Pl. W. Texas*).

Laurus Borbonia, Linnæus, *Spec.* 370 (1753). — Miller, *Dict.* ed. 8, No. 5. — Fabricius, *Enum. Hort. Helm.* 389. — Marshall, *Arbust. Am.* 73. — Castiglioni, *Viag. negli Stati Uniti*, ii. 273. — Walter, *Fl. Car.* 133. — Lamarck, *Dict.* iii. 450. — Willdenow, *Spec.* ii. pt. i. 481. — *Nouveau Duhamel*, ii. 113, t. 33. — Persoon, *Syn.* i. 449. — Desfontaines, *Hist. Arb.* i. 65.

Laurus Carolinensis, Michaux, *Fl. Bor.-Am.* i. 245 (1803). — Persoon, *Syn.* i. 449. — Desfontaines, *Hist. Arb.* i. 65. — Michaux f. *Hist. Arb. Am.* iii. 180 (excl. t. 2). — Pursh, *Fl. Am. Sept.* i. 276. — Elliott, *Sk.* i. 461. — Sprengel, *Syst.* ii. 265. — Schnizlein, *Icon.* t. 106, f. 5–12.

Laurus Caroliniana, Poiret, *Lam. Dict.* Suppl. iii. 323 (1813). — Willdenow, *Enum.* Suppl. 22. — Nuttall, *Gen.* i. 258.

Laurus Carolinensis, α **glabra**, Pursh, *Fl. Am. Sept.* i. 276 (1814).

Laurus Carolinensis, γ **obtusa**, Pursh, *Fl. Am. Sept.* i. 276 (1814).

Persea Carolinensis, C. G. Nees ab Esenbeck, *Syst. Laur.* 150 (excl. var. α) (1836). — Spach, *Hist. Vég.* x. 492. — Dietrich, *Syn.* ii. 1339. — Curtis, *Rep. Geolog. Surv. N. Car.* 1860, iii. 63. — Chapman, *Fl.* 393. — Meisner, *De Candolle Prodr.* xv. pt. i. 50. — Sargent, *Forest Trees N. Am.* 10*th Census U. S.* ix. 118. — Mez, *Jahrb. König. Bot. Gart.* v. 175 (*Lauraceæ Americanæ Monog.*). — Watson & Coulter, *Gray's Man.* ed. 6, 447.

Tamala Borbonia, Rafinesque, *Sylva Tellur.* 136 (1838).

Persea Carolinensis, α **glabriuscula**, Meisner, *De Candolle Prodr.* xv. pt. i. 51 (1864). — Mez, *Jahrb. König. Bot. Gart.* v. 176 (*Lauraceæ Americanæ Monog.*).

A tree, sixty to seventy feet in height, with a trunk two and a half to three feet in diameter, stout erect branches which form a dense shapely head, and thick fleshy yellow roots; or usually much smaller. The bark of the trunk is one half to three quarters of an inch thick, dark red, deeply furrowed, and irregularly divided into broad flat ridges which separate on the surface into small thick appressed scales. The branches, when they first appear, are many angled, light red-brown, and glabrous or coated with pale or rufous pubescence, and in their second year are terete and dark green. The winter-buds, which are unprotected by scales, are a quarter of an inch long, and coated with thick rufous tomentum. The leaves are revolute in vernation, oblong or oblong-lanceolate, entire, often slightly contracted into long points rounded at the apex, and gradually narrowed at the base into stout rigid red-brown petioles one half to two thirds of an inch in length, and flattened and somewhat grooved on the upper side; when they unfold they are thin, tinged with red, and pilose on both surfaces; and at maturity they are thick and coriaceous, bright green and lustrous on the upper surface, pale and glaucous on the lower surface, three or four inches long and three quarters of an inch to an inch and a half wide, with thickened slightly revolute margins, narrow orange-colored midribs rounded on the upper side, remote obscure primary veins arcuate near the margins, and fine closely reticulated veinlets; they appear early in the spring, and remain on the branches until after the appearance of the new growth of the following year, when they gradually turn yellow, and, falling during the spring and summer, leave small circular leaf-scars in which appear the ends of single fibro-vascular bundles. The flowers unfold in April and May in the axils of leaves of the year in two or three-flowered cymes gathered into short panicles which are borne on slender glabrous peduncles half an inch to an inch in length; they are raised on short stout pedicels furnished near the middle with two minute caducous bractlets, those of the lateral flowers of the ultimate divisions of the inflorescence being produced from the axils of small lanceolate acute deciduous bracts. The calyx is pale yellow or creamy white and about an eighth of an inch

long, with thin lobes ciliate on the margins; the lobes of the outer series are broadly ovate, rounded and minutely apiculate at the apex, puberulous on both surfaces, and about half as long as those of the inner series, which are oblong-lanceolate, acute, and coated on the inner surface with long pale hairs. The stamens are about as long as the inner lobes of the calyx, with flattened hairy filaments and rather shorter yellow anthers, which are all four-celled and fertile in the three outer series, the filaments of the third series being furnished at the base with two nearly sessile orange-colored glands rounded on the back and slightly two-lobed on the inner face; the staminodia to which the stamens of the inner series are reduced are raised on short broad stalks, and are incurved and two-lobed on the inner face and furnished at the apex with tufts of pale hairs. The ovary is ovate, glabrous, and abruptly contracted into a slender glabrous slightly exserted style thickened toward the apex, which is crowned with a flat obscurely two-lobed stigma. The fruit, which ripens in the autumn, is oblong-obovate or subglobose, half an inch long, dark blue or nearly black, and very lustrous; it is borne on the somewhat thickened pedicel, and is surrounded at the base by the enlarged and spreading lobes of the calyx, from which it separates in falling, and which remains on the branch until after the beginning of winter; the flesh is thin and dry and does not separate readily from the large ovate slightly pointed seed. The seed-coat consists of two layers; the outer is thin and cartilaginous, grayish brown on the outer surface, bright chestnut-brown and lustrous on the inner surface, which is marked by broad yellow veins radiating from the minute hilum, and is separable from the inner coat; this is membranaceous, very thin and light gray or nearly white, and closely invests and often adheres to the thick dark red-brown cotyledons which inclose at the apex the minute plumule.

Persea Borbonia is a common inhabitant of the borders of streams and swamps, where, in company with the Live Oak, the Water Oak, the Spanish Oak, the Cuban Pine, and the Hickories, it usually grows in rich moist soil; or occasionally it is found in dry sandy loam in the shade of forests of the Long-leaved Pine. The Red Bay is distributed through the coast regions of the south Atlantic and Gulf states from Virginia to the shores of Bay Biscayne and Cape Romano in Florida and to the valley of the Brazos River in Texas, and west of the Mississippi River extends northward through Louisiana to southern Arkansas.[1]

The wood of *Persea Borbonia* is heavy, hard, very strong although rather brittle, close-grained, and susceptible of receiving a beautiful polish; it contains numerous thin medullary rays and many evenly distributed open ducts, and is bright red, with thin lighter colored sapwood composed of four or five layers of annual growth. The specific gravity of the absolutely dry wood is 0.6429, a cubic foot weighing 40.07 pounds. It is occasionally used for cabinet-making and in the interior finish of houses, for which its strength, hardness, and bright color make it valuable. Formerly it was employed in ship and boat building.

The Red Bay was first described in the *Natural History of Carolina*[2] by Mark Catesby,[3] who probably introduced it into English gardens, as it was cultivated by Philip Miller[4] as early as 1739 in the Physic Garden at Chelsea near London.[5]

Although it is one of the most beautiful and valuable of the evergreen trees of the North American forests, the Red Bay has been neglected as an ornament for parks and gardens, and is now rarely seen in cultivation.

[1] Traces of *Laurus Borbonia* found in the sandstone of southern New Jersey show that this species once lived farther north than it does at present (Hallock, *Bull. Torrey Bot. Club*, xix. 332).

[2] *Laurus Carolinensis, foliis acuminatis, baccis cæruleis, pediculis longis rubris, insidentibus*, i. 63, t. 63.

Laurus foliis lanceolatis, nervis transversalibus, fructus calycibus baccatis, Linnæus, *Hort. Cliff.* 154. — Royen, *Fl. Leyd. Prodr.* 226.

[3] See vi. 16.

[4] See i. 38.

[5] Aiton, *Hort. Kew.* ii. 39 (Laurus). — Loudon, *Arb. Brit.* iii. 1299, f. 1168, 1169 (Laurus).

EXPLANATION OF THE PLATE.

PLATE CCCI. PERSEA BORBONIA.

1. A flowering branch, natural size.
2. Diagram of a flower.
3. A flower, enlarged.
4. Vertical section of a flower, enlarged.
5. A stamen of the outer series, front view, enlarged.
6. A staminodium, front view, enlarged.
7. A stamen of the third series, showing basal glands, front view, enlarged.
8. An ovule, much magnified.
9. A fruiting branch, natural size.
10. Vertical section of a fruit, enlarged.
11. An embryo, enlarged.

C.E. Faxon del. *Himely sc*

PERSEA BORBONIA, Spreng.

A. Riocreux direx.t *Imp. J. Taneur, Paris.*

PERSEA PUBESCENS.

Swamp Bay.

LEAVES oval or lanceolate, conspicuously veined, pubescent or tomentose on the lower surface. Branchlets coated with tomentum.

Persea pubescens.

Laurus Carolinensis, Michaux f. *Hist. Arb. Am.* iii. t. 2 (not Michaux) (1813).

Laurus Carolinensis, β pubescens, Pursh, *Fl. Am. Sept.* i. 276 (1814).

Persea Carolinensis, α, C. G. Nees ab Esenbeck, *Syst. Laur.* 150 (1836).

Tamala palustris, Rafinesque, *Fl. Tellur.* 137 (1838).

Persea Carolinensis, β pubescens, Meisner, *De Candolle Prodr.* xv. pt. i. 51 (1864). — Mez, *Jahrb. König. Bot. Gart.* v. 176 (*Lauraceæ Americanæ Monog.*).

Persea Carolinensis, var. **palustris,** Chapman, *Fl.* 393 (1865). — Sargent, *Forest Trees N. Am.* 10*th Census U. S.* ix. 119.

A slender tree, occasionally thirty or forty feet in height, with a trunk rarely exceeding a foot in diameter; or usually a shrub sending up from the ground numerous stems twelve or fifteen feet tall. The bark of the trunk rarely exceeds a quarter of an inch in thickness, and is dull brown and irregularly divided by shallow fissures, the surface separating into thick appressed scales. The branches are stout, and terete or slightly angled while young, and when they first appear are coated with rusty tomentum, which is reduced in their second season to a fine pubescence and does not entirely disappear until the end of their second or third year. The leaves are oval or lanceolate, and entire; they are often contracted toward the apex into long points, and are gradually narrowed at the base into stout petioles grooved on the upper side, coated with rusty tomentum, and one half to three quarters of an inch in length; when they first appear they are dark red, thin, and tomentose on both surfaces, and at maturity they are thick and coriaceous, pale green and lustrous above, pale and pubescent below, except on the midribs and primary veins, which are coated with rusty tomentum, four to six inches long, and three quarters of an inch to an inch and a half wide, with thick conspicuous veins and slightly revolute margins; they remain on the branches until after the beginning of their second year, and then turn yellow and fall gradually. The panicles of flowers are borne on stout tomentose peduncles produced from the axils of leaves of the year and two or three inches in length. The flowers are often nearly a quarter of an inch long, with thick and firm calyx-lobes coated on the outer surface with a dense rusty tomentum which likewise clothes the peduncles, the pedicels, and the minute caducous bracts and bractlets; the lobes of the outer series are broadly ovate, abruptly pointed at the apex, pubescent on the inner surface, and about half as long as those of the inner series, which are ovate-lanceolate, slightly thickened at the apex, and hairy on the inner surface. The stamens, which are slightly exserted, have flattened hairy filaments longer than the anthers; these are fertile and four-celled in the three outer series, and in the inner series are reduced to sagittate stalked staminodia, the filaments of the third series being furnished near the base with two nearly sessile glands rounded on the back and slightly two-lobed on the inner face. The ovary is ovate and glabrous, and is abruptly contracted into a glabrous style gradually enlarged at the apex into a flat slightly two-lobed stigma. The fruit ripens in the autumn and is oblong-ovate to subglobose, and very dark blue or nearly black; it is three quarters of an inch long, and in falling separates from the slightly thickened calyx and pedicel, which remain on the branch until after the beginning of winter.[1]

1 The Swamp Bay has previously been considered a variety of *Persea Borbonia;* but characteristics which appear constant, — the low wet ground always selected by this tree, the tomentum that clothes the branches and the under surface of the leaves, and the

Persea pubescens is confined to the immediate coast region of the south Atlantic and Gulf states, where it is found from North Carolina to Mississippi growing in the thin sour soil of Pine-barren swamps, which it often covers almost to the exclusion of other plants.[1]

The wood of *Persea pubescens* is heavy, soft, strong, and close-grained; it contains numerous thin medullary rays and many large open ducts, and is orange-colored streaked with brown, with thick light brown or gray sapwood composed of thirty-six or forty layers of annual growth. The specific gravity of the absolutely dry wood is 0.6396, a cubic foot weighing 39.86 pounds.

Persea pubescens was first distinguished by Frederick Pursh[2] in his *Flora Americæ Septentrionalis*, published in London in 1814.

nature of the bark and wood, — indicate a distinct species, although, except in the length of the peduncles, there are no good floral characters by which our two Perseas may be distinguished, and their fruits are identical.

[1] Elliott, *Sk.* i. 462 (under *Laurus Carolinensis*).

[2] See ii. 39.

EXPLANATION OF THE PLATE.

PLATE CCCII. PERSEA PUBESCENS.

1. A flowering branch, natural size.
2. A flower, enlarged.
3. Vertical section of a flower, enlarged.
4. A fruiting branch, natural size.
5. Vertical section of a fruit, enlarged.
6. An embryo, enlarged.

C. E. Faxon del.

Homely sc.

PERSEA PALUSTRIS, Sarg.

A. Riocreux direx.t

Imp. J. Taneur, Paris.

OCOTEA.

FLOWERS polygamo-diœcious or rarely perfect; calyx 6-lobed, the lobes in two series, imbricated in æstivation, usually deciduous; corolla 0; stamens 12, in four series, those of the inner series sterile; disk 0; ovary superior, 1-celled; ovule solitary, suspended. Fruit baccate. Leaves alternate or rarely subopposite, destitute of stipules, persistent.

Ocotea, Aublet, *Pl. Guian.* ii. 780 (1775). — A. L. de Jussieu, *Gen.* 80. — Endlicher, *Gen.* 321. — Meisner, *Gen.* 326. — Baillon, *Hist. Pl.* ii. 476. — Bentham & Hooker, *Gen.* iii. 157. — Pax, *Engler & Prantl Pflanzenfam.* iii. pt. ii. 116.

Senneberia, Necker, *Elem. Bot.* ii. 120 (1790).

Gymnobalanus, C. G. Nees ab Esenbeck, *Linnœa*, viii. 38 (1833). — Endlicher, *Gen.* 322. — Meisner, *Gen.* 326. — Baillon, *Hist. Pl.* ii. 477.

Oreodaphne, C. G. Nees ab Esenbeck, *Linnœa*, viii. 39 (1833). — Endlicher, *Gen.* 321. — Meisner, *Gen.* 326.

Mespilodaphne, C. G. Nees ab Esenbeck, *Linnœa*, viii. 45 (1833). — Endlicher, *Gen.* 319. — Meisner, *Gen.* 325. — Baillon, *Hist. Pl.* ii. 476.

Teleiandra, C. G. Nees ab Esenbeck, *Linnœa*, viii. 46 (1833). — Endlicher, *Gen.* 320. — Meisner, *Gen.* 326.

Leptodaphne, C. G. Nees ab Esenbeck, *Pl. Laur. Expos.* 16 (1833). — Endlicher, *Gen.* 320. — Meisner, *Gen.* 326.

Camphoromœa, C. G. Nees ab Esenbeck, *Pl. Laur. Expos.* 16 (1833). — Endlicher, *Gen.* 321. — Meisner, *Gen.* 326.

Strychnodaphne, C. G. Nees ab Esenbeck, *Pl. Laur. Expos.* 17 (1833). — Baillon, *Hist. Pl.* ii. 476.

Petalanthera, C. G. Nees ab Esenbeck, *Syst. Laur.* 346 (1836). — Endlicher, *Gen.* 320. — Meisner, *Gen.* 326.

Agathophyllum, Blume, *Mus. Bot. Lugd. Bat.* i. 338 (in part) (not A. L. de Jussieu) (1851).

? **Dendrodaphne**, Beurling, *Kongl. Svenska Akad.* 1854, 145 (*Prim. Fl. Portob.*) (1856).

Nemodaphne, Meisner, *De Candolle Prodr.* xv. pt. i. 109 (1864).

Aromatic trees or shrubs. Leaves scattered, alternate or rarely subopposite, penniveined, coriaceous, rigid, glabrous or more or less covered with pubescence. Flowers usually small, yellowish white, glabrous or tomentose, in cymose clusters arranged in axillary or subterminal pedunculate panicles. Pedicels slender, developed from the axils of lanceolate-acute minute bracts and furnished with two deciduous bractlets. Calyx-tube campanulate or nearly obsolete, the six lobes of the limb nearly equal, deciduous or rarely persistent under the fruit. Stamens twelve, in four series, those of the inner series reduced to staminodia; filaments inserted on the tube of the calyx, those of the outer series opposite its exterior lobes, flattened, shorter or sometimes rather longer than the anthers, glabrous or hirsute, furnished in the third series, or, in one species, in the three outer series, near the base, with two conspicuous sessile or stipitate glands; anthers oblong, flattened, four-celled, the cells superposed in pairs, opening from below upward by persistent lids, introrse in the two outer series, extrorse, subextrorse or very rarely introrse in the third series; in the pistillate flower rudimentary and sterile. Ovary one-celled, ovoid, obovoid, or subglobose, glabrous or rarely pilose, more or less immersed in the tube of the calyx, gradually narrowed into an erect short or elongated style dilated at the apex into a capitate obscurely lobed stigma; in the staminate flower linear-lanceolate, effete, or minute, or sometimes wanting; ovule solitary, suspended from the apex of the cell, anatropous; raphe ventral; micropyle superior. Fruit baccate, ellipsoidal or subglobose, nearly inclosed while young in the thickened tube of the calyx, exserted at maturity and surrounded at the base only by the cup-like truncate or slightly lobed calyx or rarely by its persistent limb; pericarp thin and fleshy. Seed ovate or subglobose, pendulous, destitute of albumen; testa thin, membranaceous. Embryo erect, filling the cavity of the seed; cotyledons thick and fleshy, inclosing the minute superior radicle turned toward the hilum.[1]

[1] By Mez, *Jahrb. König. Bot. Gart.* v. 221 (*Lauraceæ Americanæ Monog.*) the American species of Ocotea are arranged under the following subgenera: —

HEMIOCOTEA. Flowers perfect; filaments of the three outer series of stamens biglandular at the base.

DENDRODAPHNE. Flowers perfect; filaments of only the third

Nearly two hundred species [1] of Ocotea are now distinguished, the largest number being found in the tropical regions of the New World, distributed from southern Florida, where one species occurs, to Brazil and Peru; in the Old World a single species is indigenous in the Canary Islands, one inhabits South Africa, and several the Mascarene Islands.[2]

Ocotea produces hard, strong, durable, and sometimes beautifully colored wood often employed in building and cabinet-making.[3] The best known timber-trees of the genus are *Ocotea splendens* [4] of Guiana, *Ocotea fœtens* [5] of the Canary Islands, and *Ocotea bullata* [6] of South Africa. An infusion of the leaves of *Ocotea Guianensis* [7] is used in its native country in the treatment of abscesses;[8] and in Brazil a volatile limpid oil distilled from *Ocotea opifera* [9] has been employed to alleviate rheumatism.[10]

The generic name is derived from the native name of one of the species of Guiana.

series of stamens glandular; anthers of the two outer series nearly sessile, triangular or liguliform, uncontracted at the base, the connective produced above the cells, papillose.

MESPILODAPHNE. Flowers perfect; filaments of only the stamens of the third series glandular.

OREODAPHNE. Flowers dicœcious; filaments of only the stamens of the third series glandular.

[1] Humboldt, Bonpland & Kunth, *Nov. Gen. et Spec.* ii. 160. — C. G. Nees ab Esenbeck, *Syst. Laur.* 355 (Teleiandra), 358 (Lepodaphne), 380 (Oreodaphne), 467 (Camphoromœa), 471 (Ocotea), 479 (Gymnobalanus). — Meisner, *De Candolle Prodr.* xv. pt. i. 96 (Mespilodaphne), 109 (Nemodaphne), 111 (Oreodaphne), 140 (Gymnobalanus), 142 (Strychnodaphne), 143 (Camphoromœa); *Martius Fl. Brasil.* v. pt. ii. 186 (Mespilodaphne), 203 (Oreodaphne), 242 (Gymnobalanus), 243 (Strychnodaphne), 246 (Camphoromœa). — Hemsley, *Bot. Biol. Am. Cent.* iii. 72. — Mez, *Jahrb. König. Bot. Gart.* v. 219 (*Lauraceæ Americanæ Monog.*) (excl. syn. Sassafridium).

[2] Bentham & Hooker, *Gen.* iii. 157.

[3] The woods of several south African trees of the Laurel family are valued in commerce, although even the genera of the trees which produce them are still unknown.

[4] Baillon, *Hist. Pl.* ii. 466 (1870). — Mez, *l. c.* 282.

Oreodaphne splendens, Meisner, *De Candolle Prodr. l. c.* 129 (1864); *Martius Fl. Brasil.* v. pt. ii. 227.

[5] Baillon, *l. c.* (1870).

Laurus fœtens, Aiton, *Hort. Kew.* ii. 39 (1789). — Willdenow, *Spec.* ii. pt. i. 480. — Buch, *Phys. Beschr. Canar. Ins.* 140, t. 1.

Laurus Maderiensis, Lamarck, *Dict.* iii. 449 (1789).

Laurus Till, Poiret, *Lam. Dict.* Suppl. iii. 324 (1813).

Persea fœtens, Sprengel, *Syst.* ii. 268 (1825).

Oreodaphne fœtens, C. G. Nees ab Esenbeck, *l. c.* 449 (1836). — Endlicher, *Enchirid.* 205. — Webb & Berthelot, *Phytogr. Canar.* sec. iii. 226, t. 205. — Meisner, *De Candolle Prodr. l. c.* 118. — Christ, *Bot. Jahrb.* ix. 157 (*Spicilegium Canar.*).

[6] Baillon, *l. c.* 466 (1870).

Laurus bullata, Burchell, *Travels*, i. 72 (1822).

Oreodaphne bullata, C. G. Nees ab Esenbeck, *l. c.* 449 (1836). — *Bot. Mag.* lviii. t. 3931. — Meisner, *l. c.*

The Stink-hout, as this tree is called in South Africa, is common in the forests of the colony. Its wood, which smells disagreeable when cut, resembles walnut in color and is hard and durable. The wood of no other south African tree is more valued by the cabinet-maker or the gunsmith, and it is also largely used in the construction of houses and in wagon and boat building. (See Pappe, *Sylva Capensis*, 27.)

[7] Aublet, *Pl. Guian.* ii. 781, t. 310 (1775). — C. G. Nees ab Esenbeck, *l. c.* 476. — Mez, *l. c.* 296.

Ocotea sericea, Humboldt, Bonpland & Kunth, *l. c.* 162 (1817). — Kunth, *Syn. Pl. Æquin.* i. 456. — C. G. Nees ab Esenbeck, *l. c.* 478.

Persea argentea, Sprengel, *l. c.* 269 (1825).

Oreodaphne Guianensis, C. G. Nees ab Esenbeck, *Linnæa*, xxi. 268, 516 (1848). — Meisner, *l. c.* 112; *Martius Fl. Brasil.* v. pt. ii. 204.

Oreodaphne sericea, C. G. Nees ab Esenbeck, *l. c.* 516 (1848).

[8] Aublet, *l. c.* 783.

[9] Martius, *Buchner Repert.* 1830, 179. — Mez, *l. c.* 291.

Oreodaphne opifera, C. G. Nees ab Esenbeck, *Syst. Laur.* 390 (1836). — Meisner, *De Candolle Prodr.* xv. pt. i. 112.

Mespilodaphne opifera, Meisner, *l. c.* 510 (1864); *Martius Fl. Brasil.* v. pt. ii. 194, t. 71.

[10] Martius, *Syst. Mat. Med. Brasil.* 110; *Fl. Brasil.* v. pt. ii. 318 (Mespilodaphne). — Rosenthal, *Syn. Pl. Diaphor.* 235 (Oreodaphne).

OCOTEA CATESBYANA.

FLOWERS perfect; filaments of the stamens of the third series biglandular. Leaves oblong-lanceolate, pale on the lower surface.

Ocotea Catesbyana.

Laurus Catesbyana, Michaux, *Fl. Bor.-Am.* i. 244 (1803). — Poiret, *Lam. Dict.* Suppl. iii. 321. — Pursh, *Fl. Am. Sept.* i. 275 (in part). — Sprengel, *Syst.* ii. 265.

Laurus Catesbæi, Persoon, *Syn.* i. 449 (1805). — Nuttall, *Gen.* i. 258.

? Gymnobalanus Catesbyanus, C. G. Nees ab Esenbeck, *Syst. Laur.* 483 (1836).

Nectandra Willdenoviana, Meisner, *De Candolle Prodr.* xv. pt. i. 165 (in part) (not C. G. Nees ab Esenbeck) (1864). — Sargent, *Forest Trees N. Am.* 10*th Census U. S.* ix. 119.

Persea Catesbyana, Chapman, *Fl.* 393 (1865).

Nectandra coriacea, Mez, *Jahrb. König. Bot. Gart.* v. 459 (*Lauraceæ Americanæ Monog.*) (in part) (not Grisebach) (1889).

Nectandra sanguinea, Hitchcock, *Rep. Missouri Bot. Gard.* iv. 125 (not Rottboell) (1893).

A tree, twenty to thirty feet in height, with a trunk rarely exceeding eight inches in diameter, and slender spreading branches which form a narrow round-topped head. The bark of the trunk, which is about an eighth of an inch thick, is dark reddish brown, and is roughened on the otherwise smooth surface by numerous small lenticular excrescences. The branches are thin, terete, glabrous when they first appear, and dark reddish brown; they soon become lighter colored, and in their second year are light brown or gray tinged with red, and often marked by minute pale lenticels, and in their second and third years by small semiorbicular leaf-scars in which appear single central fibro-vascular bundle-scars. The leaves are alternate, oblong-lanceolate, entire, slightly contracted above into long points rounded at the apex, and gradually narrowed below into broad flat petioles, which vary from one third to one half of an inch in length, and are grooved on the upper and rounded on the lower side; when they unfold they are thin, membranaceous, light green tinged with red, and sometimes puberulous on the lower surface; and at maturity they are thick and coriaceous, dark green and lustrous above, pale below, three to six inches long, and an inch to two inches broad, with thickened slightly revolute margins, broad stout midribs impressed on the upper side toward the base, and slender remote primary veins arcuate and united near the margins and connected by coarsely reticulated conspicuous veinlets. The flowers appear in early spring, and are produced in elongated panicles with slender glabrous light red peduncles developed singly or two or three together from the axils of the leaves of the year or from those of the previous year, and three or four inches in length; they are borne on thin glabrous or puberulous pedicels bibracteolate near the middle, and when expanded are nearly a quarter of an inch across; the calyx is creamy white, with a campanulate tube much shorter than the six ovate deciduous lobes which are rounded at the apex, nearly of equal size, pubescent on the outer surface, coated with pale tomentum on the inner surface, and about twice as long as the stamens; these are in four series, those of the inner series being reduced to linear staminodia somewhat enlarged at the apex, and tipped with minute abortive anthers; the filaments of the two outer series are slightly hirsute at the base and shorter than the introrse anthers; the filaments of the third series are as long or longer than the extrorse anthers, and are furnished at the base with two conspicuous globose stalked yellow glands; the anthers are flattened, emarginate, innate and four-celled, the lower cells being a little larger and nearer the margins than the upper cells. The ovary is ovate and glabrous, and is gradually narrowed into a short glabrous style which is about as long as the stamens of the outer series. The fruit ripens in the autumn, and is ovate or subglobose, two thirds of an inch long, lustrous, dark blue or nearly black, and surrounded at the base by the thickened cup-like tube of the calyx, which is truncate or obscurely lobed and bright red like the thickened pedicels; the flesh is thin and dry, and closely invests the large

oblong seed; this is covered by a thin brittle red-brown coat, the inner layer, which is hardly separable from the outer, being light chestnut-brown, lustrous on the inner surface, and marked with broad lighter colored veins radiating from the small hilum. The embryo is a third of an inch long and bright red-brown.

Ocotea Catesbyana inhabits the shores and islands of Florida south of Cape Canaveral on the east coast and of Cape Romano on the west coast; comparatively common except on some of the western keys, it is most abundant and attains its largest size on the rich wooded hummocks adjacent to Bay Biscayne, where it grows with the Wild Fig, the Live Oak, the Gumbo Limbo, the Mastic, the Cuban Pine, and the Eugenias. It is not rare on the Bahamas, and probably grows on some of the Antilles.

The wood of *Ocotea Catesbyana* is heavy, hard, close-grained, containing numerous thin medullary rays and many small regularly distributed open ducts; it is rich dark brown in color, with thick bright yellow sapwood composed of twenty to thirty layers of annual growth. The specific gravity of the absolutely dry wood is 0.7693, a cubic foot weighing 47.94 pounds.

Ocotea Catesbyana appears to have been first noticed by Mark Catesby,[1] who found this tree on the Bahama Islands, and published the earliest account of it in his *Natural History of Carolina;*[2] as a Florida plant it was first described by Bernard Romans[3] in the *Natural History of East and West Florida.*[4]

The lustrous foliage of this small tree, the abundant clusters of white flowers which cover it in early spring, and the brilliant fruit, make it beautiful at all seasons of the year, and well worth cultivation in tropical gardens.

[1] See vi. 16.

[2] *Cornus, foliis Salicis Laureæ acuminatis; floribus albis; fructu Sassafras,* ii. 28, t. 28.

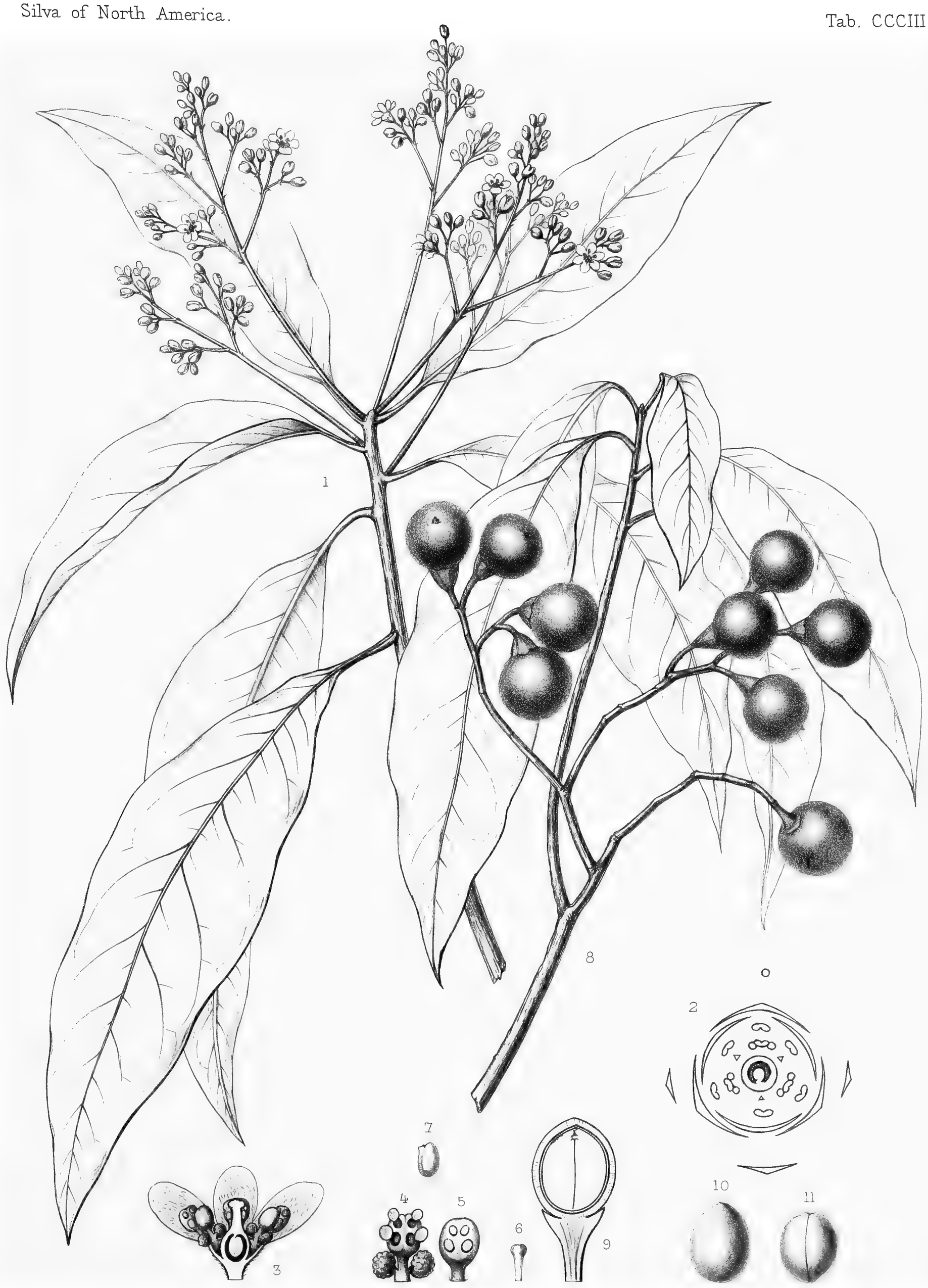
[3] See iv. 5.

[4] *Laurus foliis acuminatis, baccis cæruleis; pedicellis longis rubris insidentibus,* 27.

EXPLANATION OF THE PLATE.

PLATE CCCIII. OCOTEA CATESBYANA.

1. A flowering branch, natural size.
2. Diagram of a flower.
3. Vertical section of a flower, enlarged.
4. A stamen of the third series with glands, front view, enlarged.
5. A stamen of the outer series, front view, enlarged.
6. A staminodium, enlarged.
7. An ovule, much magnified.
8. A fruiting branch, natural size.
9. Vertical section of a fruit, enlarged.
10. A seed, enlarged.
11. An embryo, enlarged.



C.E. Faxon del. *Rapine sc.*

OCOTEA CATESBYANA, Sarg.

A. Riocreux direx.t *Imp. J. Taneur, Paris.*

SASSAFRAS.

FLOWERS diœcious or rarely perfect; calyx 6-lobed, the lobes in two series, nearly equal, imbricated in æstivation, deciduous; corolla 0; stamens 9, in three series; disk 0; ovary superior, 1-celled; ovule solitary, suspended. Fruit baccate. Leaves alternate, destitute of stipules, deciduous.

Sassafras, Nees ab Esenbeck & Ebermaier, *Handb. Med.-Pharm. Bot.* i. 418 (1830). — Endlicher, *Gen.* 322. — Meisner, *Gen.* 327. — Baillon, *Hist. Pl.* ii. 479. — Bentham & Hooker, *Gen.* iii. 160. — **Pax**, *Engler & Prantl Pflanzenfam.* iii. pt. ii. 119.

An aromatic tree, with thick deeply furrowed dark red-brown bark, scaly buds, slender light green lustrous brittle branches containing a thick white mucilaginous pith and marked with small semiorbicular elevated leaf-scars displaying single horizontal rows of minute fibro-vascular bundle-scars, and stout spongy stoloniferous roots covered with thick yellow bark. Flower-bearing buds terminal, ovate, acute, protected by nine or ten imbricated scales increasing in size from without inwards, the three outer scales ovate, rounded and often apiculate at the apex, keeled and thickened on the back, pale yellow-green below, dull yellow-brown above the middle, loosely imbricated, slightly or not at all accrescent, deciduous at the opening of the bud, much smaller than the scales of the next rows; these thin, accrescent at maturity, light yellow-green, turning dull red before falling, obovate, rounded at the apex, cuneate below, concave, coated on the outer surface with soft silky pubescence, glabrous and lustrous on the inner surface, reflexed, often three quarters of an inch long, nearly half an inch broad, tardily deciduous; the two inner scales foliaceous, lanceolate-acute, light green, coated on the outer surface with delicate pale hairs, glabrous on the inner surface, infolding the leaves and falling as these begin to expand; sterile and axillary buds much smaller. Leaves involute, the lower inclosing those above it in the bud, ovate or obovate, entire or often one to three-lobed at the apex, the lobes broadly ovate, acute, divided by deep broad sinuses, gradually narrowed at the base into elongated slender petioles flattened or slightly grooved on the upper side and rounded on the lower, feather-veined with alternate veins arcuate and united, the lowest parallel with the margins, and when the leaves are lobed running to the points of the lobes, conspicuously reticulate-venulose, mucilaginous, deciduous; as they unfold light green and somewhat pilose on the upper surface with scattered white hairs, ciliate on the margins, clothed on the lower surface with a loose pubescence of long white lustrous hairs; at maturity membranaceous, dark dull green above, pale and glabrous or pubescent below. Flowers produced in early spring with the first unfolding of the leaves, the males and females usually on different individuals in lax drooping few-flowered pilose racemes developed from the axils of the large obovate bud-scales, the upper flowers of the lowest raceme opening first. Pedicels slender, rarely forked and two-flowered, ebracteolate, clothed with long pale hairs, produced from the axils of linear-acute scarious hairy deciduous bracts; or that of the terminal flower often ebracteate. Calyx pale yellow-green, divided nearly to the base into six narrow obovate concave lobes, rounded and incurved at the apex, spreading or reflexed after anthesis, those of the inner series a little larger than the others. Stamens nine, inserted in three series on the somewhat thickened margin of the shallow concave calyx-tube, those of the outer series opposite its outer lobes; filaments flattened, elongated, slightly enlarged toward the apex, incurved, light yellow, those of the inner series furnished near the base with two conspicuous orange-colored stipitate glands rounded on the back and obscurely lobed on the inner face; anthers innate, oblong, flattened, truncate or slightly emarginate at the apex, rounded or wedge-shaped at the

base, orange-colored, introrse, four-celled, the cells superposed in pairs, the lower larger than the upper, opening from below upward by persistent lids, larger and nearer the margin in the anthers of the inner series of stamens than in the others; in the female flower reduced to flattened ovate pointed slightly two-lobed dark orange-colored stipitate staminodia, or occasionally fertile and similar to or only a little smaller than those of the staminate flower. Ovary ovate, one-celled, light green, glabrous, nearly sessile in the short tube of the calyx, contracted into a slender elongated simple style gradually enlarged above into a capitate oblique obscurely lobed stigma; ovule suspended from the apex of the cell, anatropous. Fruit an oblong dark blue lustrous berry surrounded at the base by the enlarged and thickened obscurely six-lobed or truncate scarlet limb of the calyx raised on a much elongated scarlet stalk thickened above the middle; pericarp thin and fleshy, adherent to the oblong pointed light brown seed destitute of albumen; testa thin, membranaceous, barely separable into two coats, the inner coat much thinner than the outer, dark chestnut-brown, and lustrous. Embryo erect, subglobose, filling the cavity of the seed; cotyledons thick and fleshy; radicle superior, turned toward the hilum, included between the cotyledons.

The wood of Sassafras is soft, weak, brittle, and coarse-grained, although very durable when placed in contact with the soil; it contains numerous thin medullary rays and bands of three or four rows of large open ducts which clearly mark the layers of annual growth; it is aromatic and dull orange-brown, with thin light yellow sapwood composed of seven or eight layers of annual growth. The specific gravity of the absolutely dry wood is 0.5042, a cubic foot weighing 31.42 pounds. It is largely used for fence-posts and rails, in the construction of light boats and ox-yokes, and in cooperage.

The roots of Sassafras, and especially their bark, are a mild aromatic stimulant;[1] and oil of sassafras, used to perfume soap and other articles, is distilled from them.[2] The pith of the young branches infused with water furnishes a mucilage which has been used successfully as an emulsion in febrile and inflammatory maladies,[3] and in ophthalmic practice. Gumbo filet, a powder prepared from the leaves by the Choctaw Indians of Louisiana, gives flavor and consistency to gumbo soup.[4]

Sassafras is now confined to temperate eastern North America. It once inhabited the Arctic Circle, and long existed in Europe with many forms;[5] in North America during the cretaceous period it ranged far westward of its present home to the mid-continental plateau, where traces of what are believed to be several species have been detected.[6]

In the middle of the sixteenth century the French in Florida learned from the Indians the medical value of the Sassafras,[7] and in 1569 the first account and figure of this tree were published by the

[1] Kalm, *Travels*, English ed. i. 146, 340. — Woodville, *Med. Bot.* i. 91, t. 31 (Laurus). — Bigelow, *Med. Bot.* ii. 142, t. — Nees ab Esenbeck, *Pl. Med.* t. 131. — Descourtilz, *Fl. Méd. Antill.* vii. 51, t. 464. — Stephenson & Churchill, *Med. Bot.* iii. t. 126. — Hayne, *Arzn.* xii. t. 19. — Endlicher, *Enchirid.* 204. — Griffith, *Med. Bot.* 551. — Schauer, *Am. Jour. Pharm.* 1863, 53. — Porcher, *Resources of Southern Fields and Forests*, 350. — Proctor, *Proc. Am. Pharm. Assoc.* 1866, 217. — Flückiger & Hanbury, *Pharmacographia*, 483. — *Nat. Dispens.* ed. 2, 1274. — Bentley & Trimen, *Med. Pl.* iii. 220, t. 220. — Spons, *Encyclopædia of the Industrial Arts, Manufactures, and Raw Commercial Products*, i. 823; ii. 1430.

[2] The oil of sassafras is manufactured principally in Pennsylvania, Virginia, and North Carolina by small operators who use the most primitive domestic stills, extracting the oil in the crudest manner from all parts of the tree except the leaves. It is traded by the manufacturers with local storekeepers, who collect and send it to dealers in large cities. The industry is a declining one, synthetical oils now replacing Sassafras oil for ordinary uses; and Sassafras oil is rarely found pure in commerce, being usually diluted with oil of camphor, which has the odor and specific gravity of Sassafras oil, and is a second product obtained in the distilling of Camphor oil.

[3] Johnson, *Man. Med. Bot. N. A.* 239, f. 152. — *U. S. Dispens.* ed. 16, 1338.

[4] Robin, *Voyages*, iii. 361.

[5] Saporta, *Origine Paléontologique des Arbres*, 223. — Zittel, *Handb. Palæontolog.* ii. 495.

[6] Lesquereux, *Rep. U. S. Geolog. Surv.* vi. 77 (*Contrib. Foss. Fl. Western Territories*, i.).

[7] "Des Espagnols de San-Matheo & de Saint Augustin, c'est à dire, de la Riviere Dauphine & de la Riviere de May, étant presque tous attaqués de fiévres causées par la mauvaise nourriture, & les eaux cruës & troubles qui ils bûvoient, des François leur apprirent à user du Sassafras, comme ils l'avoient vû pratiquer aux Sauvages; ils en coupoient la racine en petits morceaux, qu'ils faisoient boüillir dans l'eau, ils bûvoient de cette eau à jeûn & à leurs repars, & elle les guérit parfaitment." (Charlevoix, *Hist. de la Nouvelle France*, i. 46.)

Spanish physician Nicolás Monardes.[1] Exaggerated ideas of the curative properties of Sassafras soon spread through Europe;[2] and extraordinary efforts were made to secure large supplies of the wood and roots.[3]

Sassafras is little injured by insects,[4] and is not subject to serious fungal diseases.[5]

Sassafras was first used as a popular name by the French in Florida; and when the genus, which had been included by earlier botanists with Laurus, was distinguished by Nees ab Esenbeck he adopted Sassafras as its name.

[1] *Del Arbol que traen de la Florida, llamado Sassafras, Hist. Med.* fol. 51, t.

Sassafras arbor Monardi, Dalechamps, *Hist. Gen. Pl.* 1786, f. — Plukenet, *Phyt.* t. 222, f. 6.

The Sassafras or Ague-tree, Gerarde, *Herball*, 1340, f. — Parkinson, *Theatr.* 1606, f. — Jan de Laet, *Nov. Orb.* 216, t.

Arbor ex Florida ficulneo folio, C. Bauhin, *Pinax*, 431.

Sassafras, sive Lignum Pavanum, J. Bauhin, *Hist. Pl.* i. 483, t.

De Sassafras, Jonston, *Dendrographia*, 218, t. 65, f.

"The Sassafras is a Medicinal Tree whose Bark & Leaves yield a pleasant Smell: it profits in all Diseases of the Blood, and Liver, particularly in all Venereal and Scorbutic Distempers." (*Carolina, or a Description of the Present State of that Country*, published by A. T. Gent, London, 1682.)

Sassafras, Panckow, *Herb.* ed. Zorn, 361. — Hermann, *Cat. Hort. Lugd. Bat.* 537. — Ray, *Hist. Pl.* ii. 1568. — Blackwell, *Coll. Stirp.* iii. t. 267.

Saxafras, Pomet, *Hist. Gen. Drog.* 113.

Cornus mas odorata, folio trifido, margine plano, Sassafras dicta, Plukenet, *Alm. Bot.* 120. — Catesby, *Nat. Hist. Car.* i. 55, t. 55. — Miller, *Dict.* ed. 3, No. 5.

Sassafras Arbor folio Ficulneo, Munting, *Phyt. Cur.* 5, t. 20.

De Ligno Sassafras, Zorn, *Botanolog. Med.* 608.

Laurus flore & fructu remoto in eadem planta, foliis integris & trilobis, Kramer, *Tent. Bot.* 141.

Laurus foliis integris & trilobis, Linnæus, *Hort. Cliff.* 154; *Mat. Med.* 65. — Clayton, *Fl. Virgin.* 62. — Royen, *Fl. Leyd. Prodr.* 227. — Colden, *Act. Hort. Ups.* 1743, 119 (*Pl. Novebor.*). — Duhamel, *Traité des Arbres*, i. 350, t. 135, f. 7. — Trew, *Pl. Ehret*, 334, t. 69, 70; *Nov. Act. Phys. Med. Acad. Cæs. Leopold Carol.* ii. 344 (*Hist. Nat. Arb. Sassafras*).

Salsafras, Le Page Du Pratz, *Histoire de la Louisiane*, ii. 36, t.

Laurus seu Cornus Mas odorata, folio trifido, margine plano, Sassafras dicta, Romans, *Nat. Hist. Florida*, 20.

[2] As early as 1627 Johann Neander published in Bremen a medical treatise devoted to the virtue of the Sassafras-tree and entitled *Sassafrasologia*. I have been unable to examine a copy of the work, which, so far as I can discover, is not in any American library.

[3] One of the objects of the English expedition which, in 1602, made the earliest attempt to establish a settlement on the coast of New England was to obtain a supply of sassafras (see *The Relation of Captain Gosnold's Voyage to the North part of Virginia, begun the six-and-twentieth of March, Anno* 42 *Elizabethæ Reginæ*, 1602, *and delivered by Gabriel Archer, a gentleman in the said voyage* [*Coll. Mass. Hist. Soc.* ser. 3, viii. 77]); and eight years later sassafras is mentioned among the articles to be sent home in the instructions of the English government to the colony of Virginia (*Colonial Papers*, i. No. 23). (See, also, the *Historie of Travaile into Virginia Britannia*, by William Strachey, ed. Major, 129.)

During two centuries, at least, the wood and the bark of the roots of the Sassafras-tree were considered valuable remedies for syphilis, rheumatism, and dropsy; but their specific medicinal principles have been one after another disproved; and although sassafras is still sometimes used in Europe in combination with sarsaparilla and guaiacum, in the United States it is now valued in medicine only as a mild aromatic stimulant.

The bark of the root contains a volatile oil, camphorous matter, resin, wax, and a decomposed product of tannic acid to which the name of sassafrid has been given. The volatile oil and tannic acid render it stimulant and astringent; used as an adjuvant to more efficacious medicines, it improves their flavors, but excessive doses have produced narcotic poisoning. (See *U. S. Dispens.* ed. 16, 1339.)

[4] The large handsome larvæ of *Papilio Troilus*, Linnæus, are often abundant on the Sassafras, living on the leaves, which they partially fold together by silken threads to protect themselves. The larvæ of *Attacus Promethea*, Harris, also feed on the leaves of this tree, and in winter the cocoons may frequently be found hanging from the branches. A small moth, *Gracilaria sassafrasella*, Chambers, in its larval stages is believed to mine within the young leaves, and later to roll them downwards. A number of other species of insects which feed upon a variety of plants have occasionally affected Sassafras, but it is not attacked by borers in the living wood.

[5] The Sassafras is attacked by numerous fungi peculiar to this host. A disease of frequent occurrence, causing circumscribed brown spots on the leaves, is due to *Phyllosticta Sassafras*, Cooke, of which the mature condition is seldom seen; and the imperfectly known *Rhytisma Sassafras*, Schweinitz, covers them with thickened black spots. The woody parts of the tree are attacked by several species of Pyrenomycetes; these are most prevalent in the southern part of the country.

SASSAFRAS SASSAFRAS.

Sassafras.

Sassafras Sassafras, Karsten, *Pharm.-Med. Bot.* 505 (1882). — Sudworth, *Garden and Forest*, iv. 166.

Laurus Sassafras, Linnæus, *Spec.* 371 (1753). — Miller, *Dict.* ed. 8, No. 7. — Du Roi, *Harbk. Baumz.* i. 356. — Wangenheim, *Beschreib. Nordam. Holz.* 71; *Nordam. Holz.* 82, t. 27, f. 56. — Marshall, *Arbust. Am.* 74. — Castiglioni, *Viag. negli Stati Uniti*, ii. 273. — Walter, *Fl. Car.* 134. — Willdenow, *Berl. Baumz.* 166; *Spec.* ii. pt. i. 485; *Enum.* 435. — Lamarck, *Dict.* iii. 454. — Abbot, *Insects of Georgia*, i. t. 11. — *Nouveau Duhamel*, ii. 115, t. 34. — Borkhausen, *Handb. Forstbot.* ii. 1708. — Michaux, *Fl. Bor.-Am.* i. 244. — Persoon, *Syn.* i. 450. — Desfontaines, *Hist. Arb.* i. 66. — Du Mont de Courset, *Bot. Cult.* ed. 2, ii. 430. — Titford, *Hort. Bot. Am.* 130. — Michaux, f. *Hist. Arb. Am.* iii. 173, t. 1. — Pursh, *Fl. Am. Sept.* i. 277. — Bigelow, *Fl. Boston.* 97. — Rafinesque, *Fl. Ludovic.* 25. — Nuttall, *Gen.* i. 259; *Sylva*, i. 88. — Elliott, *Sk.* i. 464. — Jaume St. Hilaire, *Traité des Arbres*, i. t. 95. — Audubon, *Birds*, t. 144.

Laurus variifolia, Salisbury, *Prodr.* 344 (1796).

Laurus diversifolia, Stokes, *Bot. Mat. Med.* ii. 426 (1812).

Laurus albida, Nuttall, *Gen.* i. 259 (1818).

Tetranthera albida, Sprengel, *Syst.* ii. 267 (1825).

Persea Sassafras, Sprengel, *Syst.* ii. 270 (1825). — Schnizlein, *Icon.* t. 106, f. 15–23.

Sassafras officinale, Nees ab Esenbeck & Ebermaier, *Handb. Med.-Pharm. Bot.* i. 418 (1830). — C. G. Nees ab Esenbeck, *Syst. Laur.* 488. — Dietrich, *Syn.* ii. 1357. — Spach, *Hist. Vég.* x. 503. — Torrey, *Fl. N. Y.* ii. 158. — Darlington, *Fl. Cestr.* ed. 3, 251. — Curtis, *Rep. Geolog. Surv. N. Car.* 1860, iii. 63. — Chapman, *Fl.* 394. — Meisner, *De Candolle Prodr.* xv. pt. i. 171. — Koch, *Dendr.* ii. 365. — Emerson, *Trees Mass.* ed. 2, ii. 359, t. — Ridgway, *Proc. U. S. Nat. Mus.* 1882, 70. — Lauche *Deutsche Dendr.* 357, f. 138. — Sargent, *Forest Trees N. Am. 10th Census U. S.* ix. 119. — Mez, *Jahrb. König. Bot. Gart.* 484 (*Lauraceæ Americanæ Monog.*). — Watson & Coulter, *Gray's Man.* ed. 6, 447. — Coulter, *Contrib. U. S. Nat. Herb.* ii. 383 (*Man. Pl. W. Texas*).

Sassafras albidum, C. G. Nees ab Esenbeck, *Syst. Laur.* 490 (1836).

Sassafras variifolium, Otto Kuntze, *Rev. Gen. Pl.* ii. 574 (1891). — Koehne, *Deutsche Dendr.* 172. — Dippel, *Handb. Laubholzk.* iii. 95.

A tree, occasionally eighty or ninety feet in height, with a trunk sometimes nearly six feet in diameter, and short stout more or less contorted branches which spread almost at right angles from the trunk, forming a narrow usually flat-topped head; frequently not more than forty or fifty feet in height, and at the north generally smaller and often shrubby. The bark of the trunk is sometimes an inch and a half in thickness, dark red-brown, and deeply and irregularly divided into broad flat ridges separating into thick appressed scales on the surface. The branchlets, when they first appear, are light yellow-green and coated with pale pubescence; they soon become glabrous, bright green, and lustrous, and at the end of two or three years gradually turn reddish brown, and begin to show the shallow fissures which divide the thin bark of the older branches and young stems. The leaves are four to six inches long and two to four inches wide, and are borne on petioles three quarters of an inch to an inch and a half in length; in the autumn they turn to delicate shades of yellow or of orange more or less tinged with red. The flowers are produced in racemes about two inches long and a third of an inch across when fully expanded. The fruits ripen in September or October, and are a third of an inch long and raised on stalks an inch and a half to two inches in length; when ripe they separate from the thick calyx-lobes which, with the stalks of the fruit-clusters, remain on the branches until the beginning of winter. Exceedingly abundant in some years, the fruit of the Sassafras is generally produced rather sparingly, and is usually devoured by birds as soon as it begins to assume its brilliant colors.

Sassafras Sassafras is distributed from eastern Massachusetts through southern Vermont to southern Ontario[1] and central Michigan, southeastern Iowa, eastern Kansas and the Indian Territory, and southward to central Florida and the valley of the Brazos River in Texas.

[1] Brunet, *Cat. Vég. Lig. Can.* 42. — Bell, *Geolog. Rep. Can.* 1879–80, 55°. — Macoun, *Cat. Can. Pl.* 419.

The Sassafras is usually found in rich sandy well-drained loam, and in the south Atlantic and Gulf states its stoloniferous roots often take possession of fields abandoned by the agriculturist.

The Sassafras was probably one of the first North American trees introduced into European gardens, as the figure of the branch, published in 1633, in the second edition of Gerarde's *Herball*,[1] was made from a specimen that had grown in a Mr. Wilmote's garden near London. Few inhabitants of the forests of North America are more beautiful or interesting at all seasons of the year; in winter, with its bright green shining branchlets; in spring, with the charm of its drooping clusters of flowers surrounded by the expanding scales of the buds; in summer, with the healthy green of its graceful variously shaped leaves; and in autumn, with its brilliant fruit and delicate hues of fading foliage unsurpassed in loveliness by the deeper colors of its forest companions.

The Sassafras can be propagated by seeds, which should be sown as soon as they are ripe, when they will germinate early the following spring, or by root-suckers, which are often produced in great profusion. The large thick fleshy roots which penetrate deep into the ground make the Sassafras difficult to transplant, and small plants should be selected for this purpose.

[1] Gerarde, *Herball*, ed. Johnson, 1524. — Aiton, *Hort. Kew.* ii. 40. — Loudon, *Arb. Brit.* iii. 1301.

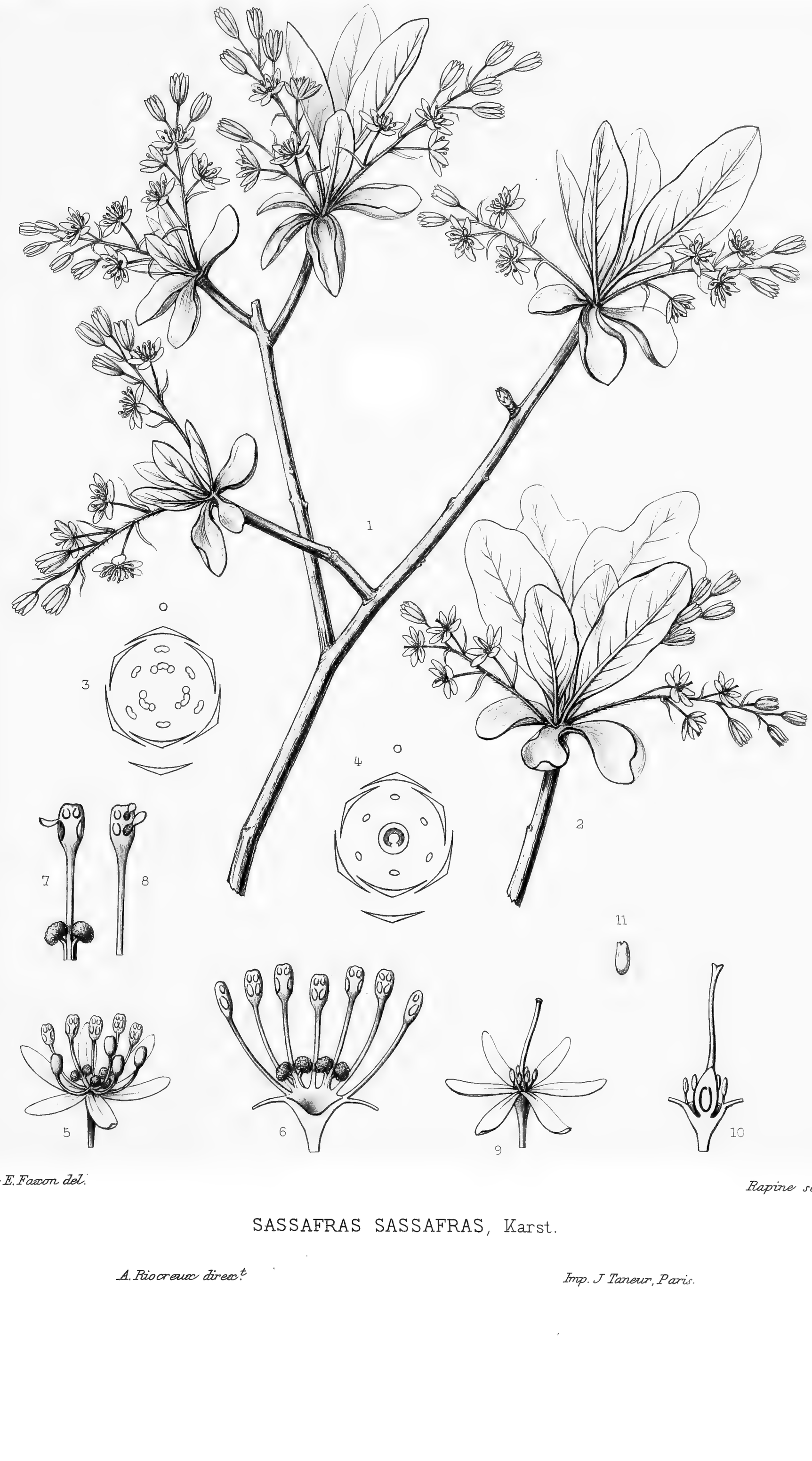
EXPLANATION OF THE PLATES.

Plate CCCIV. Sassafras Sassafras.

1. A flowering branch of the staminate tree, natural size.
2. A flowering branch of the pistillate tree, natural size.
3. Diagram of a staminate flower.
4. Diagram of a pistillate flower.
5. A staminate flower, enlarged.
6. Vertical section of a staminate flower, enlarged.
7. A stamen of the inner series, enlarged.
8. A stamen of one of the outer series, enlarged.
9. A pistillate flower, enlarged.
10. Vertical section of a pistillate flower, enlarged.
11. An ovule, much magnified.

Plate CCCV. Sassafras Sassafras.

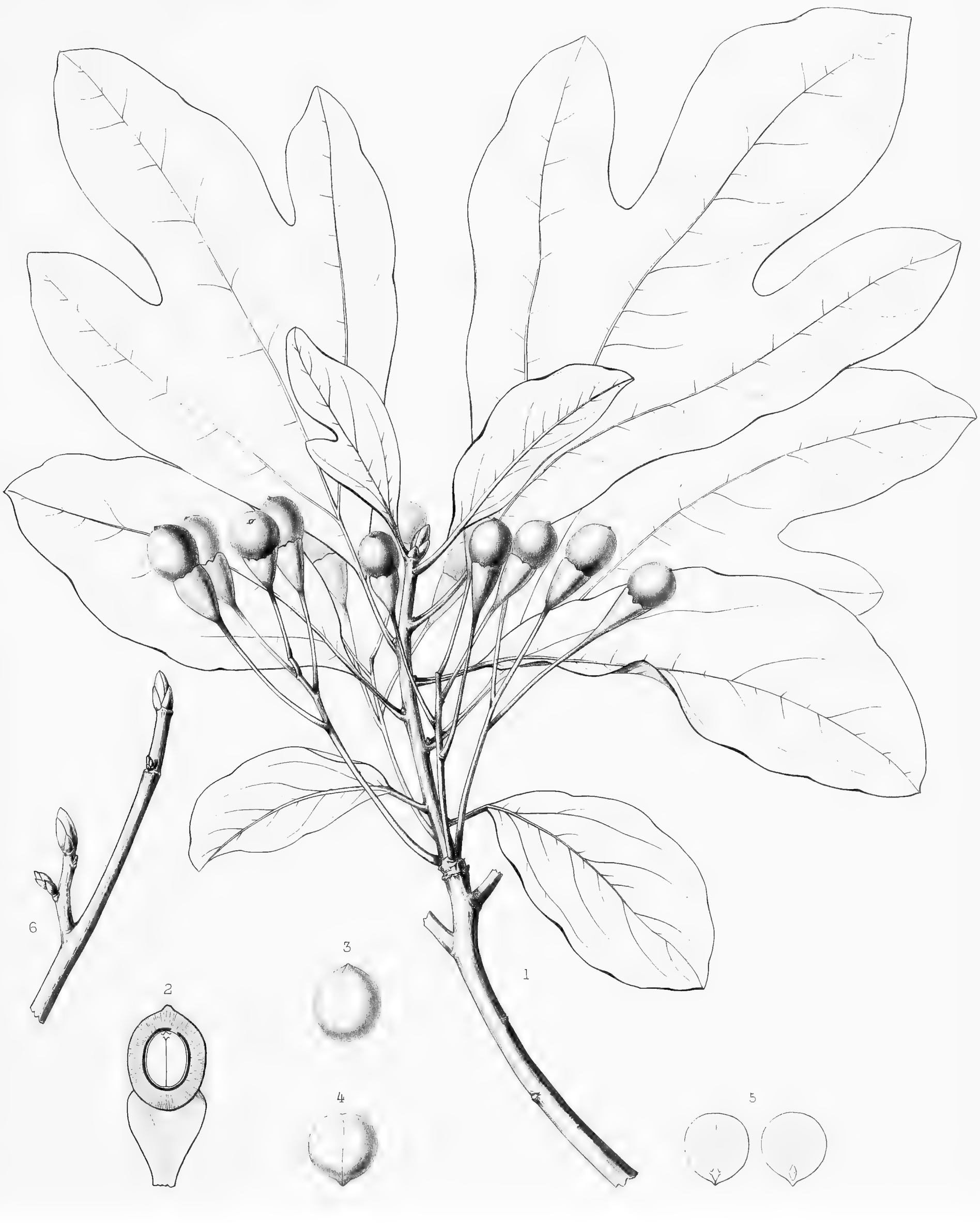
1. A fruiting branch, natural size.
2. Vertical section of a fruit, enlarged.
3. A seed, enlarged.
4. An embryo, enlarged.
5. Sections of an embryo, enlarged.
6. A winter branchlet, natural size.



C. E. Faxon del. Rapine sc.

SASSAFRAS SASSAFRAS, Karst.

A. Riocreux direct.t Imp. J Taneur, Paris.



C.E. Faxon, del — Himely, sc.

SASSAFRAS SASSAFRAS, Karst.

A. Riocreux direx.t — Imp. J. Taneur, Paris.

UMBELLULARIA.

FLOWERS perfect; calyx 6-lobed, the lobes in two series, imbricated in æstivation, deciduous; corolla 0; stamens 12, in four series, those of the inner series sterile; disk 0; ovary superior, 1-celled; ovule solitary, suspended. Fruit baccate. Leaves alternate, destitute of stipules, persistent.

Umbellularia, Nuttall, *Sylva*, i. 87 (1842). — Bentham & Hooker, *Gen.* iii. 162. — Pax, *Engler & Prantl Pflanzenfam.* iii. pt. ii. 116.

Oreodaphne, Subgen. **Umbellularia**, C. G. Nees ab Esenbeck, *Syst. Laur.* 462 (1836). — Endlicher, *Gen.* 321.

Drimophyllum, Nuttall, *Sylva*, i. 85 (1842).

An aromatic tree, with dark brown scaly bark, slender terete branches marked in their second and third years by small semicircular or nearly triangular elevated leaf-scars displaying a horizontal row of minute fibro-vascular bundle-scars, naked buds, and thick fleshy brown roots. Leaves alternate, involute in vernation, lanceolate or ovate-lanceolate, acute or rounded at the narrow apex, cuneate or somewhat rounded at the base, entire, with thickened slightly revolute margins, petiolate, the broad petioles grooved on the upper side, pungent; at first coated on the lower surface with pale soft pubescence and puberulous on the upper surface, at maturity thick and coriaceous, dark green and lustrous above, dull and paler below, with slender light yellow midribs rounded on both sides, penniveined, the veins remote, obscure, arcuate and more or less united near the margins, connected by conspicuous reticulate veinlets. Flowers in axillary pedunculate many-flowered umbels inclosed before anthesis by an involucre of five or six imbricated broadly ovate or obovate pointed concave yellow puberulous caducous scales, the latest umbels subsessile, at the base of terminal leaf-buds. Pedicels slender, puberulous, ebracteolate, developed from the axils of obovate membranaceous puberulous deciduous bracts decreasing in size from the outer to the inner. Perianth divided almost to the base into six nearly equal broadly obovate rounded pale yellow lobes spreading and reflexed after anthesis. Stamens inserted on the short slightly thickened tube of the calyx; filaments flat, glabrous, pale yellow, rather shorter than the anthers, those of the third series furnished near the base with two conspicuous stipitate orange-colored orbicular flattened glands; anthers innate, oblong, flattened, light yellow, four-celled, those of the first and second series introrse, those of the third series extrorse, the cells superposed in pairs opening from below upward by persistent lids; stamens of the fourth series reduced to minute ovate acute yellow staminodia. Ovary sessile, ovate, often more or less gibbous, glabrous, abruptly contracted into a stout columnar style rather shorter than the lobes of the calyx and crowned with a simple capitate discoid stigma; ovule solitary, suspended from the apex of the cell, anatropous. Fruit ovate, one-seeded, surrounded at the base by the enlarged and thickened truncate or lobed tube of the calyx, yellow-green, sometimes more or less tinged with dull red; pericarp thin and fleshy. Seed ovate, exalbuminous, light brown; testa separable into two coats, the outer thick, hard, and woody, the inner thin and papery, closely investing the embryo, chestnut-brown, very lustrous on the inner surface. Embryo erect, filling the cavity of the seed; cotyledons thick and fleshy, inclosing the minute superior thick and fleshy conical radicle turned toward the hilum.

The wood of Umbellularia is heavy, hard, strong, close-grained, and susceptible of receiving a beautiful polish; it contains numerous small regularly distributed open ducts and many thin medullary rays, and is light rich brown, with thick lighter colored sapwood composed of thirty to forty layers of annual growth. The specific gravity of the absolutely dry wood is 0.6517, a cubic foot weighing 40.61 pounds. The most valuable wood produced in the forests of Pacific North America for the interior

finish of houses and furniture, it is largely employed for these purposes; and on the Oregon coast it is used in ship and boat building for jaws, bits, cleats, cross-trees, etc.

The leaves yield by distillation[1] a pungent volatile oil; and from the fruit a fat containing umbellulic acid has been obtained.[2]

Umbellularia is not seriously injured by insects[3] or fungal diseases.[4]

The generic name, a diminutive of *umbella*, relates to the character of the inflorescence. The genus consists of a single species.

[1] All parts of Umbellularia contain volatile oil, although it is most abundant in the leaves; it is limpid and straw-color, with a pungent aromatic odor resembling that of a mixture of nutmeg and cardamom, and a camphorous taste. When inhaled, the oil of Umbellularia produces dizziness and headache, and is supposed to have marked action on the nervous system. It is recommended for nasal catarrh and nervous headache; and its use in the treatment of cerebro-spinal meningitis is said to have been followed by favorable results. It is believed to possess curative properties in chronic diarrhœa and colic, and to relieve rheumatic pains if applied externally (Heamy, *Am. Jour. Pharm.* xlvii. 106. — *New Properties*, iii. 223, 288. — Parke, Davis & Co., *New Remedies*, No. 10, 136. — *U. S. Dispens.* ed. 16, 1947).

[2] Stillman & O'Neill, *Am. Chem. Jour.* iv. 206. — *New Remedies*, xii. 50.

[3] Few insects are recorded as feeding upon Umbellularia. A beetle, *Sinoxylon decline*, Le Conte, is said to bore into the wood (*Insect Life*, iv. 260); and *Ptilinus basalis*, Le Conte, and *Micracis hirtella*, Le Conte, have been found boring in dead twigs, although they probably do not affect green tissue (*Trans. Am. Entomolog. Soc.* viii. p. xxiii.). The larvæ of a small moth, *Lithocolletis Umbellulariæ*, Walsingham, form large blister-like mines on the upper surface of the leaves (*Insect Life*, ii. 78).

A scale insect, *Aspidiotus rapax*, Comstock, is often abundant on the bark (*Rep. U. S. Dept. Agric.* 1880, 307) and the Fluted Scale (*Icerya Purchasi*, Maskell) once infested Umbellularia in some parts of California. This destructive insect was first imported into California on plants from Australia, and in time threatened the ruin of the Orange-orchards of California and many ornamental plants and forest trees. For several years the artificial remedies tried were unsuccessful in keeping the pest in control. Studies, however, of its habits and enemies made by the entomologists of the United States Department of Agriculture in its original home led to the importation of the Australian Ladybird Beetle (*Vedalia cardinalis*, Mulsant), a predaceous insect which in a short time multiplied enormously in California and soon practically cleared the scale from the orchards and gardens of the state. (See *Bull.* 21, *Division of Entomology, U. S. Dept. Agric.* — *Third Biennial Rep. State Board, Hort. Cal.* 246, t. 4. — *Annual Rep. State Board Hort. Cal.* 1889, 267, t. 4.)

[4] More than thirty species of fungi are recorded as growing on *Umbellularia Californica*, although they are mostly species which are found also on other plants; but *Anthostoma Oreodaphnes*, Cooke & Harkness, *Nectria Umbellulariæ*, Plowright & Harkness, and *Sphærella Umbellulariæ*, Cooke & Harkness, are, however, peculiar to this tree although they do not produce serious diseases.

UMBELLULARIA CALIFORNICA.

California Laurel. Spice Tree.

Umbellularia Californica, Nuttall, *Sylva*, i. 87 (1842). — Brewer & Watson, *Bot. Cal.* ii. 61. — Sargent, *Forest Trees N. Am.* 10*th Census U. S.* ix. 120. — Mez, *Jahrb. König. Bot. Gart.* v. 482 (*Lauraceæ Americanæ Monog.*). — Dippel, *Handb. Laubholzk.* iii. 96, f. 46. — Greene, *Man. Bay Region Bot.* 8. — Coville, *Contrib. U. S. Nat. Herb.* iv. 192 (*Bot. Death Valley Exped.*).

Tetranthera? Californica, Hooker & Arnott, *Bot. Voy. Beechey*, 159 (1833). — Meisner, *De Candolle Prodr.* xv. pt. i. 192. — Torrey, *Bot. Wilkes Explor. Exped.* 451.

Oreodaphne Californica, C. G. Nees ab Esenbeck, *Syst. Laur.* 463 (1836). — Bentham, *Pl. Hartweg.* 334; *Bot. Voy. Sulphur*, 49. — Dietrich, *Syn.* ii. 1356. — Hooker & Arnott, *Bot. Voy. Beechey*, 389. — Torrey, *Pacific R. R. Rep.* iv. 133; v. 364; *Bot. Mex. Bound. Surv.* 184. — Newberry, *Pacific R. R. Rep.* vi. 24, f. 3, 88. — *Bot. Mag.* lxxxviii. t. 5320.

Drimophyllum pauciflorum, Nuttall, *Sylva*, i. 85, t. 22 (1842).

The California Laurel is a tree eighty to ninety feet in height, with a trunk four or five feet in diameter, sometimes tall and straight but usually dividing near the ground into several large diverging stems, and stout spreading branches which form a broad round-topped compact head; or at high elevations above the level of the sea and in southern California much smaller and often reduced to a low shrub. The bark of the trunk is three quarters of an inch to an inch in thickness, and dark brown tinged with red, separating on the surface into thin appressed scales. The branches, when they first appear, are light green and coated with soft pale pubescence; they soon become glabrous and yellow-green, and in their second and third seasons are light brown tinged with red. The leaves are two to five inches long and half an inch to an inch and a half wide, and are borne on petioles which vary from a quarter to a half of an inch in length; they first unfold in the winter or early in the spring, continuing to appear as the branches lengthen until late in the autumn, and, beginning to fade during the summer, turn to a beautiful yellow or orange-color and fall one by one during their second season, or often remain on the branches until the sixth year, or gradually become rusty brown, dry, and more or less curled. The flowers, which are produced in many-flowered umbels on pedicels sometimes an inch in length, are a third of an inch across when fully expanded; they first appear in January or February before the unfolding of the young leaves, in the axils of those of the previous year, from buds formed the previous summer, and at this season often quite cover the tree with their star-like clusters. Later, as the leaves of the year develop on the young branches, occasional flower-clusters appear in their axils, and thus the trees are frequently in blossom during several months of the spring and summer. The fruit is about an inch long, and hangs in clusters of two or three on its elongated thickened stalks which remain on the branch after the fruit ripens and falls late in the autumn. The seeds germinate soon after they reach the ground, the fruit remaining below the surface of the soil and attached to the young plants until midsummer, when they are often six or eight inches tall.

Umbellularia Californica[1] is distributed from the valley of the Rogue River in Oregon through the California coast ranges and along the high western slopes of the Sierra Nevada to the southern slopes of the San Bernardino Mountains, which it ascends to an elevation of twenty-five hundred feet.[2] It usually grows near the banks of watercourses, and sometimes on low hills when vertical strata of rock permit it to send down its roots to drink at deep subterranean springs. A common tree wherever it can obtain an abundant supply of water, the California Laurel is most abundant and attains its greatest size in the rich valleys of southwestern Oregon, in which, accompanied by the broad-leaved Maple, it sometimes forms a considerable part of the forest growth.

[1] *Umbellularia Californica* is also sometimes called Mountain Laurel, Cajeput, California Olive, and Bay-tree.

[2] S. B. Parish, *Zoë*, iv. 344.

Umbellularia Californica was made known to Europeans by Archibald Menzies,[1] the physician and naturalist who sailed with Vancouver on his voyage of discovery, being probably first seen by him in November, 1792, on the shores of the Bay of San Francisco. In Oregon it was discovered[2] in 1826 by David Douglas,[3] who introduced it into the gardens of Europe, where it is occasionally cultivated.

The California Laurel is one of the stateliest and most beautiful inhabitants of the North American forests, and no evergreen tree of temperate regions surpasses it in the beauty of its dark dense crown of lustrous foliage and in the massiveness of habit which make it one of the most striking features of the California landscape and fit it to stand in any park or garden.

[1] See ii. 90.

[2] Hooker, *Compan. Bot. Mag.* ii. 127 (*Laurus regia*).

[3] See ii. 94.

EXPLANATION OF THE PLATE.

Plate CCCVI. Umbellularia Californica.

1. A flowering branch, natural size.
2. Diagram of a flower.
3. An umbel of flowers with expanding involucre, enlarged.
4. A flower, enlarged.
5. Vertical section of a flower, enlarged.
6. A stamen of the first or second series, front view, enlarged.
7. A stamen of the third series, front view, enlarged.
8. A staminodium, enlarged.
9. A pistil, enlarged.
10. An ovule, much magnified.
11. A fruiting branch, natural size.
12. Vertical section of a fruit, slightly enlarged.
13. An embryo, natural size.

C.E. Faxon del. *Himely sc.*

UMBELLULARIA CALIFORNICA, Nutt.

A. Riocreux direx.t *Imp J. Taneur, Paris*

DRYPETES.

FLOWERS diœcious; calyx 4 to 6-parted, the divisions imbricated in æstivation; corolla 0; stamens as many as the divisions of the calyx, or about twice as many; disk hypogynous, pulvinate; ovary 1 or rarely 2-celled; ovules 2 in each cell, suspended. Fruit drupaceous. Leaves alternate, entire, or obscurely sinuate-toothed, stipulate, persistent.

Drypetes, Vahl, *Eclog.* iii. 49 (1807). — Endlicher, *Gen.* 1124. — Meisner, *Gen.* 344. — Baillon, *Étude Gén. Euphorb.* 606; *Hist. Pl.* v. 248 (excl. *Hemicyclia* and *Cyclostemon*). — Bentham & Hooker, *Gen.* iii. 278. — Pax, *Engler & Prantl Pflanzenfam.* iii. pt. v. 25.

Liparena, Poiteau, *Dict. Sci. Nat.* xxvii. 6 (1823).

Freireodendron, Mueller Arg., *De Candolle Prodr.* xv. pt. ii. 244 (1862). — Baillon, *Hist. Pl.* v. 248.

Trees or shrubs, with thick milky juice and terete branchlets. Leaves involute in vernation, alternate, petiolate, penniveined, coriaceous, persistent; stipules minute, caducous. Flowers axillary, sessile or pedicellate, the males in many-flowered clusters, the females solitary or in few-flowered clusters. Pedicels developed from the axils of minute deciduous bracts, ebracteolulate. Calyx divided nearly to the base into four to six lobes rounded or acute at the apex, deciduous or persistent under the fruit. Stamens inserted under the margin of a flat or concave slightly lobed disk; filaments filiform; anthers ovate, emarginate, attached on the back near the base, extrorse or introrse, two-celled, the cells affixed to a broad oblong connective, opening longitudinally, wanting in the pistillate flower. Ovary sessile on a thick lobed disk, ovoid, one or rarely two-celled, crowned by one or two sessile or subsessile peltate or reniform stigmas; rudimentary or wanting in the sterile flower; ovules two in each cell, collateral, descending, attached to the central angle of the cell, operculate with a hood-like body developed from the placenta, anatropous; raphe ventral; micropyle extrorse, superior. Fruit drupaceous, ovoid, or subglobose, tipped with the withered remnants of the stigmas, one-celled and one-seeded, or rarely two-celled and two-seeded; exocarp thick and corky or thin and crustaceous; endocarp thick or thin, osseous or crustaceous. Seed filling the cavity of the nutlet, estrophiolate; testa crustaceous or membranaceous. Embryo erect in thin fleshy albumen; cotyledons broad and flat, much longer than the superior radicle.

Drypetes is confined to the tropical regions of the New World, where it is distributed from southern Florida through the West Indies to eastern Brazil. Eleven species[1] are now distinguished, of which two inhabit Florida.

Drypetes produces hard durable wood, but is not known to possess other useful properties.

The generic name, from *δρύπτα*, relates to the character of the fruit.

[1] Mueller Arg., *De Candolle Prodr.* xv. pt. ii. 453; *Martius Fl. Brasil.* xi. pt. ii. 79, t. 12. — Urban, *Bot. Jahrb.* xv. 351.

CONSPECTUS OF THE NORTH AMERICAN SPECIES.

Calyx 5-lobed; stamens 8; ovary 1-celled; fruit oblong; exocarp thick and mealy; nutlet thick-walled . . . . . 1. D. KEYENSIS.

Calyx 4-lobed; stamens 4; ovary 2-celled; fruit subglobose; exocarp thin, crustaceous; nutlet thin-walled . . . . . 2. D. LATERIFLORA.

DRYPETES KEYENSIS.

White Wood.

CALYX 5-lobed; stamens 8; ovary 1-celled. Fruit oblong; exocarp thick and mealy; nutlet thick-walled.

Drypetes Keyensis, Urban, *Bot. Jahrb.* xv. 354 (1893).

Drypetes glauca, Nuttall, *Sylva*, ii. 68 (not Vahl) (1849). — Chapman, *Fl.* 410.

Drypetes crocea, var. **latifolia**, Sargent, *Forest Trees N. Am.* 10*th Census U. S.* ix. 121 (not Mueller Arg.) (1884).

A tree, occasionally thirty to forty feet in height, with a trunk sometimes a foot in diameter, and stout usually erect branches which form an oblong round-topped head. The bark of the trunk is half an inch thick, smooth, milky white, and often marked with large irregular gray or pale brown blotches. The branchlets, when they first appear, are light green tinged with red, and covered with pale scattered caducous hairs, and in their first winter are stout, ashy gray, and roughened with numerous elevated circular pale lenticels, and later with large prominent orbicular leaf-scars in which appear three conspicuous fibro-vascular bundle-scars. The buds are minute, obtuse, partly immersed in the bark, and coated with brown resin. The leaves are entire, oval, or oblong, often more or less falcate, acute, acuminate, rounded or rarely emarginate at the apex, and rounded or wedge-shaped at the base, which is sometimes rounded on one side and gradually narrowed on the other; when they unfold they are thin and membranaceous, light green or green tinged with red, and pilose with scattered pale hairs; and at maturity they are thick and coriaceous, dark green and lustrous, rather paler on the lower than on the upper surface, three to five inches long, and one to two inches wide, with broad thick pale midribs raised and rounded on the upper side, and obscure primary veins arcuate and united near the thick revolute cartilaginous margins and connected by conspicuous coarsely reticulated veinlets; they are borne on stout yellow midribs rounded below, grooved above, and half an inch in length, and in Florida appear in early spring and fall during their second year. The stipules are nearly triangular, and rather less than a sixteenth of an inch long, and disappear before the leaves are half grown. The flowers open in early spring in the axils of leaves of the previous year, the males in many-flowered clusters, the females usually solitary or occasionally in two or three-flowered clusters, on pedicels rather shorter than the petioles. The calyx is yellow-green, hirsute on the outer surface, and about a sixteenth of an inch long, and is divided nearly to the base into five ovate acute boat-shaped lobes deciduous from the fruit. In the male flower, which shows no trace of a pistil, there are about eight stamens inserted on the borders of the slightly lobed tomentose pulvinate concave disk; the filaments are unequal in length and rather longer than the lobes of the calyx and a little longer than the broadly ovate emarginate anthers, which are nearly as broad as they are long, pilose and introrse, with broad ovate acute connectives. The ovary of the female flower, which is sessile on a broad slightly lobed disk, is hirsute, one-celled, and crowned with the broad sessile or slightly stalked oblique pulvinate stigma. The fruit ripens in the autumn, and is ovoid, an inch long, and ivory white, with thick dry mealy flesh closely investing the light brown nutlet, which is narrowed at the base into a long point, and has bony walls an eighth of an inch in thickness and penetrated longitudinally by large fibro-vascular bundle channels; it is borne on a stout erect stalk, much enlarged at the apex, and a third of an inch in length, from which it separates in falling. The seed is oblong, rounded at both ends, nearly half an inch long, and covered with a thin membranaceous light brown coat marked with conspicuous veins radiating from the small hilum.

The wood of *Drypetes Keyensis* is heavy, hard, not strong, brittle, and close-grained; it contains numerous obscure medullary rays, and is brown, streaked with bright yellow, with thick dull brown sapwood. The specific gravity of the absolutely dry wood is 0.9346, a cubic foot weighing 58.24 pounds.

Drypetes Keyensis inhabits Key West, Umbrella and Elliott's Keys on the coast of southern Florida, growing in dry sandy soil with the shrubby Eugenias, the Gumbo Limbo, the Pisonias, the Florida Coccolobis, the Pigeon Plum, the Princewood, and the Marlberry, which form a large part of the shrubby growth that now replaces the original forest-covering of many of the Florida keys. One of the rarest of the tropical trees in Florida, *Drypetes Keyensis*, is conspicuous for its milk-white bark, dark and lustrous foliage, and large white egg-like fruits.

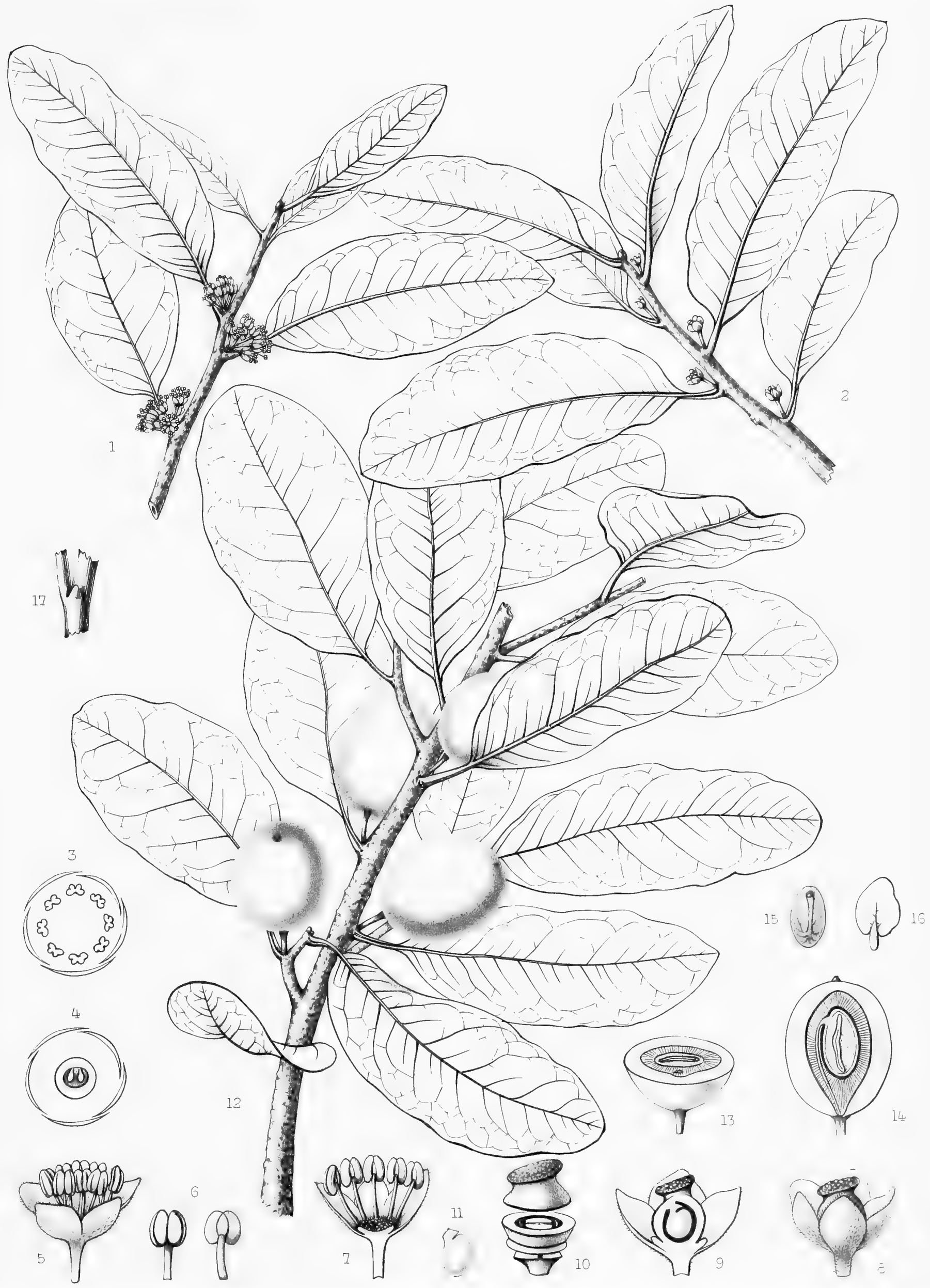
It was discovered on Key West, from which it has now almost completely disappeared, by Dr. J. L. Blodgett.[1]

[1] See i. 33.

EXPLANATION OF THE PLATE.

Plate CCCVII. Drypetes Keyensis.

1. A flowering branch of the staminate tree, natural size.
2. A flowering branch of the pistillate tree, natural size.
3. Diagram of a staminate flower.
4. Diagram of a pistillate flower.
5. A staminate flower, enlarged.
6. An anther, front and rear views, enlarged.
7. Vertical section of a staminate flower, enlarged.
8. A pistillate flower, enlarged.
9. Vertical section of a pistillate flower, enlarged.
10. Transverse section of a pistil, enlarged.
11. An ovule, much magnified.
12. A fruiting branch, natural size.
13. Cross section of a fruit, natural size.
14. Vertical section of a fruit, natural size.
15. A seed, showing raphe, natural size.
16. An embryo, enlarged.
17. A young leaf with stipule, enlarged.



C. E. Faxon del. Toulet sc.

DRYPETES KEYENSIS, Urb.

A. Riocreux dirext Imp. J. Taneur, Paris.

DRYPETES LATERIFLORA.

Guiana Plum.

Calyx 4-lobed; stamens 4; ovary 2-celled. Fruit subglobose; exocarp thin, crustaceous; nutlet thin-walled.

Drypetes lateriflora, Urban, *Bot. Jahrb.* xv. 357 (1893).

Schæfferia lateriflora, Swartz, *Prodr.* 30 (1788); *Fl. Ind. Occ.* i. 329.

Kœlera laurifolia, Willdenow, *Spec.* iv. pt. i. 750 (in part) (1805).

Bessera spinosa, Sprengel, *Pugill.* ii. 91 (1815).

Drypetes crocea, Poiteau, *Mém. Mus.* i. 159, t. 8 (1815). — Nuttall, *Sylva*, ii. 66, t. 63. — Chapman, *Fl.* 410. — Grisebach, *Fl. Brit. W. Ind.* 32; *Cat. Pl. Cub.* 15. — Mueller Arg., *De Candolle Prodr.* xv. pt. ii. 455. — Sargent, *Forest Trees N. Am.* 10*th Census U. S.* ix. 120.

Limacia laurifolia, F. G. Dietrich, *Lexic. Gartn. u. Bot. Nachtr.* iv. 334 (1818).

Roumea coriacea, Steudel, *Nom. Bot.* ed. 2, ii. 475 (not Poiteau) (1841).

Drypetes sessiliflora, Baillon, *Étude Gén. Euphorb.* Atlas, 45, t. 24, f. 34–36, 38, 40 (1858).

Drypetes glauca, A. Richard, *Fl. Cub.* iii. 218 (not Vahl) (1855). — Grisebach, *Mem. Am. Acad.* n. ser. viii. 157 (*Pl. Wright.*); *Nachr. Kgl. Gesell. Gött.* 1865, 165; *Cat. Pl. Cub.* 15.

Drypetes alba, var. **latifolia**, Grisebach, *Nachr. Kgl. Gesell. Gött.* 1865, 165; *Cat. Pl. Cub.* 15.

Drypetes crocea, β **longipes**, Mueller Arg., *De Candolle Prodr.* xv. pt. ii. 456 (1866).

Drypetes crocea, γ **latifolia**, Mueller Arg., *De Candolle Prodr.* xv. pt. ii. 456 (1866).

Drypetes latifolia, Sauvalle, *Fl. Cub.* 127 (1873).

Xylosma nitidum, Hooker f. & Jackson, *Ind. Kew.* ii. 802 (not Grisebach) (1893).

A tree, twenty to thirty feet in height, with a short trunk five or six inches in diameter, and slender erect branches. The bark of the trunk is a sixteenth of an inch thick, and light brown tinged with red, the generally smooth surface separating into small irregular scales. The branchlets are terete and slender, and when they first appear are light green tinged with red; in their first winter they are ashy gray and are marked with scattered pale lenticels, and at the end of their second year with the small elevated oval leaf-scars which display the ends of three fibro-vascular bundles. The buds are minute, acute or obtuse, chestnut-brown, and coated with pale hairs. The leaves are oblong, acute or acuminate at the apex, gradually narrowed at the base, and entire; when they unfold they are thin and covered with scattered pale hairs, and at maturity are thick and subcoriaceous, dark green and lustrous, three to four inches in length, and half an inch to an inch and a half in breadth, with conspicuous light-colored midribs rounded above and below, and obscure primary veins arcuate and united near the slightly thickened revolute margins and connected by slender reticulated veinlets; they are borne on slender grooved petioles a quarter of an inch long, and appear in Florida in the early spring, falling during their second year. The flowers open late in the autumn or early in the winter, on branches one or two years old, in the axils of leaves or from leafless nodes, in many or few-flowered clusters on pedicels shorter than the petioles. The calyx is greenish white, hirsute on the outer surface, divided to the base into four ovate rounded lobes, and persistent under the fruit; in the male flower, in which there is no trace of an ovary, there are four stamens inserted under the margin and between the lobes of the flat tomentose disk, with slender exserted filaments and introrse emarginate pilose anthers. In the female flower the ovate tomentose two-celled ovary sits on a broad slightly lobed disk, and is surmounted by two nearly sessile oblique spreading cushion-like stigmas. The fruit, which ripens during the spring and early summer, is subglobose, a third of an inch in diameter, tipped with the conspicuous blackened remnants of the stigmas, dark brown and coated with soft pubescence; it is solitary or produced in clusters of two or three, and is borne on stout stalks enlarged at the apex and a quarter of an inch in length, from which it separates in falling; the flesh is thin and crustaceous,

and closely invests the thin-walled crustaceous nutlet. The seed is obovate, gibbous, an eighth of an inch long, rounded below, narrowed and marked at the apex with the elevated pale hilum, from which numerous broad veins radiate, and on the inner surface with the broad conspicuous raphe.

The wood of *Drypetes lateriflora* is heavy, hard, brittle, and close-grained; it contains numerous thin medullary rays, and is rich dark brown in color, with thick yellow sapwood. The specific gravity of the absolutely dry wood is 0.9209, a cubic foot weighing 57.39 pounds.

Drypetes lateriflora inhabits in Florida the shores of Bay Biscayne and many of the southern keys; it is also common on the Bahama Islands and on Cuba, San Domingo, Jamaica, and Porto Rico.

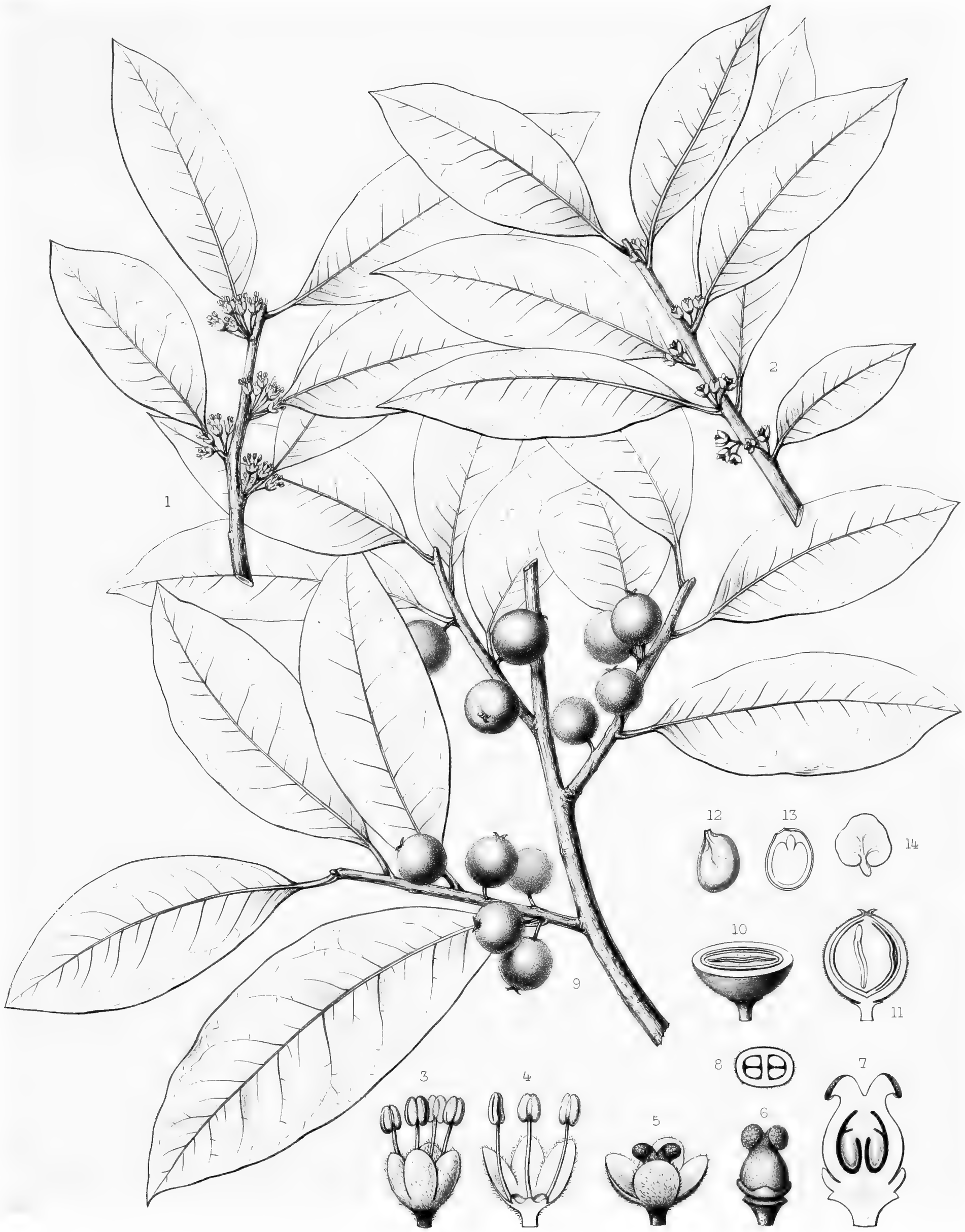
Drypetes lateriflora was discovered toward the end of the last century by the Swedish botanist Swartz[1] on the island of San Domingo. In the United States it was first noticed on Key West by Dr. J. L. Blodgett.

[1] See v. 44.

EXPLANATION OF THE PLATE.

PLATE CCCVIII. DRYPETES LATERIFLORA.

1. A flowering branch of a staminate tree, natural size.
2. A flowering branch of a pistillate tree, natural size.
3. A staminate flower, enlarged.
4. Vertical section of a staminate flower, enlarged.
5. A pistillate flower, enlarged.
6. A pistillate flower, the calyx removed, enlarged.
7. Vertical section of a pistil, enlarged.
8. Cross section of an ovary, enlarged.
9. A fruiting branch, natural size.
10. Cross section of a fruit, enlarged.
11. Vertical section of a fruit, enlarged.
12. A seed, enlarged.
13. Vertical section of a seed, enlarged.
14. An embryo, enlarged.



C.E. Faxon del. Rapine sc.

DRYPETES LATERIFLORA, Urb.

A. Riocreux direx.t Imp. J. Taneur, Paris.

GYMNANTHES.

FLOWERS monœcious or rarely dicœcious; calyx rudimentary or 0; corolla 0; stamens 2 or rarely 3; disk 0; ovary 3-celled; ovule solitary in each cell, suspended. Fruit a 3-lobed capsule splitting into three 2-valved cocci. Leaves alternate, stipulate, persistent.

Gymnanthes, Swartz, *Prodr.* 95 (1788). — Endlicher, *Gen.* Suppl. ii. 87; iv. pt. iii. 87 (Gymnanthus). — Baillon, *Étude Gén. Euphorb.* 530. — Bentham & Hooker, *Gen.* iii. 337. — Pax, *Engler & Prantl Pflanzenfam.* iii. pt. v. 101.

Excœcaria, Baillon, *Hist. Pl.* v. 227 (in part) (1874).

Glabrous trees or shrubs, with milky juices and slender terete branchlets. Leaves alternate, petiolate, entire or crenulate-serrate, coriaceous, penniveined, persistent; stipules membranaceous, minute, caducous. Inflorescence-buds covered with closely imbricated chestnut-brown scales, lengthening in anthesis, bearing in the upper axils numerous three-branched clusters of staminate flowers, their branches furnished with minute ovate bracts, and from the lower axils two or three long-stalked pistillate flowers. Perianth of the staminate flower minute or wanting. Stamens two or rarely three; filaments filiform, declinate in anthesis, inserted on the slightly enlarged torus, free or slightly connate at the base; anthers attached on the back below the middle, erect, ovoid, two-celled, the cells parallel, opening longitudinally. Perianth of the pistillate flower reduced to three bract-like scales. Ovary ovate, three-celled, narrowed into three recurved styles free or slightly united at the base, stigmatic on their inner face; ovule solitary in each cell, suspended from its inner angle, anatropous; raphe ventral; micropyle extrorse, superior; the obdurator or enlarged cup-like growth from the funicle only slightly developed. Capsule three-lobed, separating from the persistent axis into three two-valved cocci, dehiscent on the dorsal and partly on the ventral suture. Seed ovoid or subglobose, strophiolate, or rarely naked; testa membranaceous or crustaceous. Embryo erect in thick fleshy albumen; cotyledons foliaceous, broad and flat, much longer than the superior radicle.

About ten species[1] of Gymnanthes are distributed from southern Florida, where one species occurs, through the West Indies to Mexico[2] and Brazil.[3]

Gymnanthes produces hard, durable, and sometimes handsome wood, but is not known to possess other useful properties.

The generic name, from *γυμνός* and *ἄνθος*, relates to the structure of the naked flowers.

[1] Bentham & Hooker, *Gen.* iii. 337.

[2] Hemsley, *Bot. Biol. Am. Cent.* iii. 136.

[3] Mueller Arg., *Martius Fl. Brasil.* xi. pt. ii. 566 (Sebastiania).

GYMNANTHES LUCIDA.

Crab Wood.

PERIANTH of the staminate flower 0; stamens 2 or 3; ovary long-stalked. Leaves oblong-obovate to ovate-lanceolate.

Gymnanthes lucida, Swartz, *Prodr.* 96 (1788). — Baillon, *Étude Gén. Euphorb.* 530. — Mueller Arg., *Linnæa*, xxxii. 100. — Hitchcock, *Rep. Missouri Bot. Gard.* iv. 129.

Excœcaria lucida, Swartz, *Fl. Ind. Occ.* ii. 1122 (1800). — Willdenow, *Spec.* iv. 865. — Persoon, *Syn.* ii. 634. — Poiret, *Lam. Dict.* Suppl. i. 155. — A. de Jussieu, *Euphorb. Tent.* t. 16, f. 55. — Nuttall, *Sylva*, ii. 60, t. 61. — Dietrich, *Syn.* v. 256. — Richard, *Fl. Cub.* iii. 199. — Chapman, *Fl.* 405. — Grisebach, *Fl. Brit. W. Ind.* 50; *Cat. Pl. Cub.* 20. — Eggers, *Vidensk. Medd. fra nat. For. Kjöbenh.* 1876, 145 (*Fl. St. Croix*).

Sebastiania lucida, Mueller Arg., *De Candolle Prodr.* xv. pt. ii. 1181 (1866). — Eggers, *Bull. U. S. Nat. Mus.* No. 13, 92 (*Fl. St. Croix and the Virgin Islands*). — Sargent, *Forest Trees N. Am. 10th Census U. S.* ix. 121.

A tree, occasionally twenty to thirty feet in height, with a trunk six or eight inches in diameter and often irregularly ridged, the rounded ridges spreading near the surface of the ground into broad buttresses, and with slender erect branches which form a narrow loose oblong head. The bark of the trunk is dark red-brown and a sixteenth of an inch thick, and separates into large thin scales, which, in falling, display the light brown inner bark. The branchlets are terete and slender, and, when they first appear, are light green and more or less deeply shaded with red; in their first winter they are light gray-brown faintly tinged with red and roughened by numerous oblong pale lenticels; ultimately they become ashy gray, and are marked at the end of their second year with semiorbicular elevated leaf-scars in which appear four fibro-vascular bundle-scars superposed in pairs. The leaf-buds are ovate, obtuse, covered with chestnut-brown scales, and about one sixteenth of an inch in length. The leaves are conduplicate in vernation, oblong-obovate to ovate-lanceolate, and obscurely and remotely crenulate-serrate or often entire; when they unfold they are thin and membranaceous, deeply tinged with red, and furnished on the teeth with minute caducous dark glands, and at maturity they are thick and coriaceous, dark green and lustrous on the upper, and pale and dull on the lower surface, two to three inches long, and two thirds of an inch to an inch and a half wide, with broad pale midribs raised and rounded on the upper side, obscure primary veins arcuate and united near the margins, and connected by prominent coarsely reticulate veinlets, and broad slightly grooved petioles about a quarter of an inch in length; in Florida they appear in early spring, and, remaining on the branches through their second summer, fall gradually. The stipules, which disappear as soon as the leaves unfold, are ovate, acute, membranaceous, light brown, clothed on the margins with long pale hairs, and nearly a sixteenth of an inch in length. The inflorescence-buds appear in Florida late in the autumn in the axils of leaves of the year, and during the winter are an eighth of an inch long, and covered with closely imbricated scales; in the early spring they begin to lengthen, and when fully grown the inflorescence is an inch and a half to two inches long, and consists of a slender glabrous angled rachis, which, in lengthening, has separated the scales. From two or three of the lower scales the long-stalked solitary female flowers are produced, and from between the remainder the stamens of the usually triandrous male flowers protrude. The scales are broadly ovate, pointed, concave, rounded and thickened at the apex, puberulous and ciliate on the margins; those which inclose the male flowers are connate with their peduncles, and as these lengthen are carried upward, and thus remain immediately under the pedicels of the fully expanded flowers, while those subtending the female flowers at the base of the inflorescence are not raised on their peduncles. The male inflorescence consists of a peduncle terminating in three divisions, each of these divisions or

pedicels being furnished at the base before anthesis with a minute ovate bract, which, as the pedicel lengthens, is carried up, so that when the flower is fully expanded, it stands just under the slightly enlarged torus upon which the stamens are inserted. The female flower is borne on a slender dark green peduncle tinged with red, half an inch long, and furnished at its apex with three minute ovate acute unequal pubescent bracts, from which rises the stout stipe of the ovary. The fruit, which in Florida is produced sparingly, and is often injured by insects, ripens in the autumn; it is slightly obovate, dark reddish brown or nearly black, a third of an inch in diameter, covered with thin dry flesh, and hangs on a slender stem an inch or more in length; the three-valved nutlets into which it separates, leaving the white corky axis remaining on the peduncle, are thick-walled, light brown, hard and bony, and lustrous on the inner surface. The seed is ovoid, and covered by a thin chestnut-brown coat, and is marked with a conspicuous circular elevated strophiole and with a broad ventral raphe.

The wood of *Gymnanthes lucida* is very heavy, hard, close-grained, and susceptible of receiving a beautiful polish; it contains numerous obscure medullary rays, and is rich dark brown streaked with yellow, with thick bright yellow sapwood. The specific gravity of the absolutely dry wood is 1.0905, a cubic foot weighing 67.96 pounds. In Florida it is now occasionally manufactured into canes, and furnishes valuable fuel.

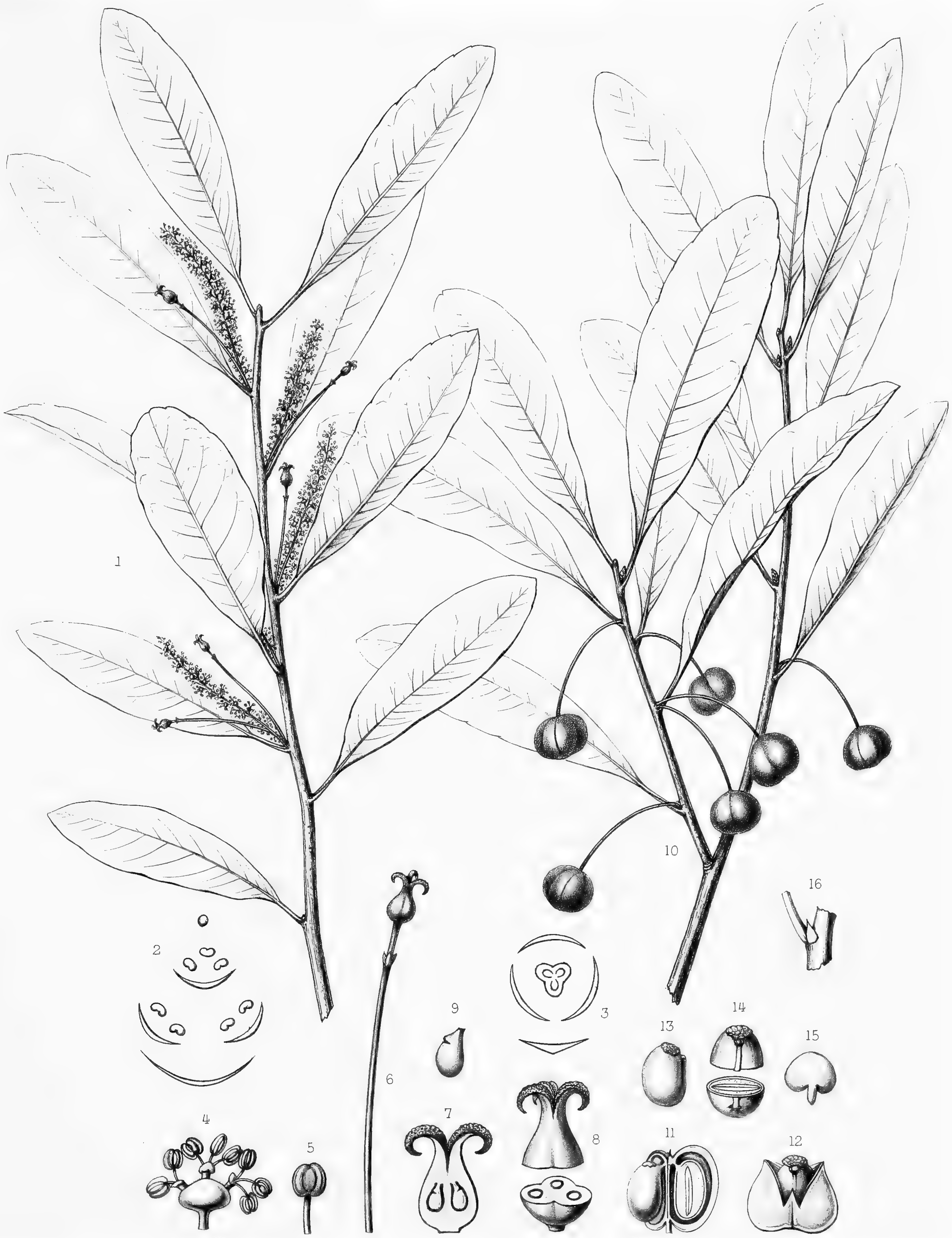
Gymnanthes lucida is a frequent inhabitant of the low woods which cover the coral formations of southern Florida from the shores of Bay Biscayne to the Marquesas keys. It is common on the Bahama Islands, and inhabits many of the Antilles.

Gymnanthes lucida was discovered by the Swedish botanist Swartz, on the island of Jamaica. In the United States it was first noticed on Key West by Dr. J. L. Blodgett.

EXPLANATION OF THE PLATE.

PLATE CCCIX. GYMNANTHES LUCIDA.

1. A flowering branch, natural size.
2. Diagram of a cluster of male flowers.
3. Diagram of a female flower.
4. A cluster of male flowers with their scale, anterior view, enlarged.
5. A stamen, enlarged.
6. A female flower with its peduncle, enlarged.
7. Vertical section of a female flower, enlarged.
8. Cross section of a female flower, enlarged.
9. An ovule, much magnified.
10. A fruiting branch, natural size.
11. Vertical section of a fruit, enlarged.
12. A coccus partly split open, displaying the ventral face of a seed, enlarged.
13. A seed, enlarged.
14. Cross section of a seed, enlarged.
15. An embryo, enlarged.
16. A stipule, enlarged.



C.E. Faxon del. *Rapine sc.*

GYMNANTHES LUCIDA, Sw.

A. Riocreux direx.t *Imp J. Taneur, Paris.*

HIPPOMANE.

FLOWERS monœcious; calyx usually 3-lobed, the lobes imbricated in æstivation; corolla 0; stamens 2 to 3, their filaments connate; disk 0; ovary superior, 6 to 9-celled; ovule solitary in each cell. Fruit drupaceous. Leaves alternate, stipulate, tardily deciduous.

Hippomane, Linnæus, *Gen.* 368 (1737). — A. L. de Jussieu, *Gen.* 391. — Endlicher, *Gen.* 1110. — Meisner, *Gen.* 337. — Baillon, *Étude Gén. Euphorb.* 539; *Hist. Pl.* v. 228. — Bentham & Hooker, *Gen.* iii. 333. — Pax, *Engler & Prantl Pflanzenfam.* iii. pt. v. 98.

Mancanilla, Adanson, *Fam. Pl.* ii. 354 (1763).

Mancinella, Tussac, *Fl. Antill.* iii. 21 (1824).

A glabrous tree, with thick milky acrid juice, scaly bark, and stout pithy branchlets marked with circular raised lenticels and oblong or semiorbicular horizontal elevated leaf-scars in which appear a row of obscure fibro-vascular bundle-scars, and nearly encircled at the nodes by ring-like scars left by the falling of the stipules. Buds ovate, acute, covered by many loosely imbricated long-pointed chestnut-brown scales. Leaves involute in vernation, broadly ovate, abruptly rounded at the apex into broad points terminating in slender mucros, rounded or subcordate at the base, remotely crenulate-serrate with minute gland-tipped teeth, penniveined, long-petiolate, pilose at first with occasional long pale hairs, soon becoming glabrous, and at maturity thick and coriaceous, dark yellow-green and lustrous above, paler and dull below; midribs stout, light yellow, raised and rounded on the upper side; primary veins slender, remote, arcuate and united at some distance from the margin, connected by conspicuous coarsely reticulated veinlets more prominent on the upper than on the lower side; petioles elongated, slender, rigid, light yellow, rounded below, obscurely grooved above, marked at the very apex with large orbicular dark red glands; stipules ovate-lanceolate, abruptly narrowed from a broad base, slightly laciniate near the apex, membranaceous, light chestnut-brown, caducous. Inflorescence terminal, spicate, appearing in early spring usually before the unfolding of leaves of the year, the stout fleshy rachis often furnished at the base with acute sterile deciduous bracts or with one or two small leaves, the two or three minute pistillate flowers solitary in the axils of these leaves and in those of ovate acute lanceolate bracts, furnished with two lateral glandular bractlets, raised on thickened lobes of the rachis; staminate flowers minute, articulate on slender pedicels, clustered in eight to fifteen-flowered fascicles in the axils of similar bracts higher on the rachis than those subtending the pistillate flowers and extending to its apex. Calyx of the staminate flower yellow-green, membranaceous, divided below the middle into three or sometimes into two acute lobes. Stamens two or often three, exserted, more or less connate by their filaments into a stout column, free and spreading from the apex; anthers ovoid, light yellow, surmounted by the short prolongation of the connective, attached on the back below the middle, erect, extrorse, two-celled, the cells opening longitudinally. Calyx of the pistillate flower ovate, yellow-green, divided nearly to the base into three ovate acute concave divisions rounded on the back. Ovary six to eight-celled, narrowed at the base and gradually contracted above into a short simple cylindrical style separating into six to eight long radiating flattened abruptly reflexed styles stigmatic on the inner face. Ovule solitary in each cell, suspended from its inner angle, descending, anatropous; raphe ventral; micropyle extrorse, superior. Fruit pome-shaped, obscurely six to eight-lobed, raised on a thickened woody stem; epicarp thin, light yellow-green or yellow and red; mesocarp thick, lactescent, adherent to the thick-walled rugose deeply and irregularly winged six to eight-celled subglobose endocarp flattened at the two ends, the cells separated throughout by thin dark radial plates,

ultimately separable, penetrated near the summit by oblique canals filled by the funicles of the seeds. Seed oblong-ovate, marked with a minute slightly elevated hilum, and on the ventral face with an obscure raphe; testa membranaceous, separable into two coats, the outer dark, the inner thinner, light brown. Embryo surrounded by thick fleshy albumen; cotyledons flat, foliaceous, much longer than the short erect radicle turned toward the hilum.

The wood of Hippomane, when grown in Florida, is light and soft although close-grained, and contains numerous evenly distributed small open ducts and many obscure medullary rays. It is dark brown, with thick light brown or yellow sapwood. The specific gravity of the absolutely dry wood is 0.5272, a cubic foot weighing 35.97 pounds.[1]

All parts of Hippomane abound in exceedingly poisonous caustic sap which produces cutaneous eruptions, and taken internally destroys the mucous membrane.[2] Rain water falling on the leaves becomes poisonous, and the smoke of the burning wood injures or destroys the eyes. In the Antilles and on the adjacent shores of South America the Caribs employed the sap to poison their arrows.[3]

The generic name, from ἵππος and μανία, used by the Greeks to distinguish some plant with properties excitant to horses,[4] was adopted for this tropical American tree by Linnæus, who discarded the older Mançanilla of Plumier.[5]

The genus is represented by a single species.

[1] By many authors the wood of Hippomane is described as heavy and hard, and as valued and much esteemed in cabinet-making; in Florida the trees rarely produce heartwood, and the sapwood is certainly too light and soft to be of any value in the arts. Of the authors who have described this tree, Tussac (*Fl. Antill.* iii. 23) appears to be the only one who has noticed the softness of the wood and its inferior quality.

[2] Peyssonel, *Rec. Périod. d'Obs. de Méd., de Chir. et de Pharm.* vii. 411. — Ricord-Madianna, *Recherches et Expériences sur les Poisons d'Amérique*, t. 3.; *N. Y. Med. & Phys. Jour.* iii. 309, 439. — Orfela & Olivier, *Arch. Gén. de Méd.* x. 358. — Schröder, *Geneesk. Tijdschr. Zeemagt. Gravenh.* i. 229. — Rosenthal, *Syn. Pl. Diaphor.* 820. — Jackson, *Med. Press & Circ.* n. ser. xlii. 304. — Guibourt, *Hist. Drog.* ed. 7, ii. 345. — Eggers, *Tidsskr. pop. Fremst. Natur.* 1878, 112. — Baillon, *Traité Bot. Méd.* 946. — Cornevin, *Des Plantes Vénéneuses*, 186. (See, also, Nicolson, *Essai sur l'Histoire Naturelle de St. Domingue*, 266. — Boyer-Peyreleau, *Les Antilles Françaises*, ed. 2, i. 71.)

[3] "Arbol ó mançanillo, con cuya fructa los indios caribes flecheros haçen la hierva con que tiran é pelean, la qual por la mayor parte es inremediable." (Oviedo, *Hist. Nat. Gen. Ind.* lib. 9, cap. 12.)

"Their poyson is of such a force, that a man being stricken therewith dyeth within foure and twentie howers, as the Spaniards do affirme, & in my judgment it is like there can be no stronger poyson as they make it, using thereunto apples which are very faire and red of colour, but are a strong poyson." (Hawkins, *Voyage to the coast of Guinea and the Indies of Nova Hispania* [Hakluyt, *Voyages*, ed. Evans, iii. 602].)

"The fruit is like an apple *John*, and 't is said to be one of those poisons, wherewith the Indian Caniballs invenome their Arrows." (Ligon, *A true and exact History of the Island of Barbados*, 68.)

"Nos Caraïbes se servent du lait de cet arbre pour empoisonner leurs fleches; ils font pour cela une fente dans l'écorce, & y mettent le bout des fleches qui s'imbibent de la liqueur qui en sort qui est blanche comme du lait, mais plus épaisse & plus gluante. Ils laissent secher les fleches ainsi imbibées, & lorsqu'elles font une playe elles l'empoisonnent en même tems." (Labat, *Nouveau Voyage aux Isles de l'Amérique*, i. 477.)

[4] Wittstein, *Etymol.-Bot. Handwörterb.* 444.

[5] *Nov. Pl. Am. Gen.* 49.

HIPPOMANE MANCINELLA.

Manchineel.

Hippomane Mancinella, Linnæus, *Spec.* 1191 (1753). — Miller, *Dict.* ed. 8, No. 1. — Jacquin, *Enum. Pl. Carib.* 31; *Hist. Stirp. Am.* 250, t. 159; *Hist. Select. Stirp. Am.* 121, t. 238. — Aublet, *Pl. Guian.* ii. 885. — *Icon. Am. Gewäch.* iii. 64, t. 283. — Lamarck, *Dict.* iii. 694; *Ill.* iii. 374, t. 793, f. 1. — Fahlberg, *Acad. Stockh. nya Handl.* xi. 221, t. 10. — Swartz, *Obs.* 369. — Willdenow, *Spec.* iv. pt. i. 571. — Persoon, *Syn.* ii. 589. — Titford, *Hort. Bot. Am.* Suppl. 9, t. 12, f. 5. — Du Mont de Courset, *Bot. Cult.* ed. 2, vi. 325. — Lunan, *Hort. Jam.* i. 482. — Humboldt, Bonpland & Kunth, *Nov. Gen. et Spec.* ii. 524. — Kunth, *Syn. Pl. Æquin.* i. 394. — Poiret, *Dict. Sci. Nat.* xxix. 2, t. 278. — A. de Jussieu, *Euphorb. Tent.* 90, t. 16, f. 54. — Link, *Enum.* ii. 407. — Sprengel, *Syst.* iii. 805. — Descourtilz, *Fl. Méd. Antill.* iii. 12, t. 153. — Maycock, *Fl. Barb.* 368. — Spach, *Hist. Vég.* ii. 524. — Nuttall, *Sylva*, ii. 54, t. 60. — Bentham, *Bot. Voy. Sulphur*, 169. — Dietrich, *Syn.* v. 224. — Richard, *Fl. Cub.* iii. 200. — Baillon, *Étude Gén. Euphorb.* 540, Atlas, t. 6, f. 12–20. — Chapman, *Fl.* 404. — Grisebach, *Fl. Brit. W. Ind.* 50; *Cat. Pl. Cub.* 19. — Regel, *Gartenflora*, xv. 163, t. 510. — Mueller Arg., *De Candolle Prodr.* xv. pt. ii. 1200. — Schnizlein, *Icon.* t. 243, f. 3. — Le Maout & Decaisne, *Traité Gén. Bot.* English ed. 693, f. — Eggers, *Vidensk. Medd. fra nat. For. Kjöbenh.* 1876, 145 (*Fl. St. Croix*); *Bull. U. S. Nat. Mus.* No. 13, 92 (*Fl. St. Croix and the Virgin Islands*). — Hemsley, *Bot. Biol. Am. Cent.* iii. 134. — Sargent, *Forest Trees N. Am.* 10*th Census U. S.* ix. 121. — Pax, *Engler & Prantl Pflanzenfam.* iii. pt. v. f. 64. — Hitchcock, *Rep. Missouri Bot. Gard.* iv. 129, 169.

Mancinella venenata, Tussac, *Fl. Antill.* iii. 21, t. 5 (1824).

A tree, in Florida rarely exceeding twelve or fifteen feet in height, with a short trunk five or six inches in diameter, but in the West Indies often fifty to sixty feet tall, with a trunk occasionally three feet in diameter, and long spreading pendulous branches which form a handsome round-topped head, or sometimes with stout erect branches. The bark of the trunk varies from a quarter to a half of an inch in thickness, and is dark brown and broken on the surface into small thick appressed irregularly shaped scales; or in the West Indies it is sometimes smooth and light gray or nearly white. The leaves are three or four inches long and an inch and a half to two inches broad, and are raised on petioles two and a half to four inches in length; unfolding in early spring, they remain on the branches in Florida until the spring of the following year, or until the appearance of the new growth. The flowers open in March before the leaves of the year, and before or after those of the preceding year have fallen. The rachis of the inflorescence is four to six inches long, dark purple, and more or less covered with a glaucous bloom. The fruit, which ripens in the autumn or early winter, and often remains on the branches until after the flowers of the succeeding year appear, is an inch to an inch and a half in diameter, and light yellow or yellow-green with a bright red cheek.

Hippomane Mancinella is a common inhabitant of sandy beaches and dry knolls in the immediate neighborhood of the ocean, from the keys which stretch along the southern coast of Florida, and the Bahama Islands, through the Antilles to the northern countries of South America, and the eastern and western coasts of Central America and southern Mexico.

The Manchineel, which resembles a Pear-tree in habit and in the form and color of its leaves, growing in abundance close to the shores and covered with tempting fruit, raised in the breasts of early European travelers in the New World hopes of pleasantness and plenty which were soon to give way to disappointment and dismay; and many of the narratives of their journeys, beginning with that of the second voyage of Columbus,[1] who found the Manchineel on the island of Marie Galante, allude to the

1 "Allí habia frutas salvaginas de diferentes maneras, de las quales algunos no muy sabios probaban, y del gusto solamente tocándoles con las lenguas se les hinchaban las caras, y les venia tan grande ardor y dolor que parecian que rabiaban, los cuales se remediaban con cosas frias." (*Select Letters of Columbus*, ed. Major, 23.)

"Toman los Venados, emponçoñando las Balsas donde beben,

attractive appearance and dangerous properties of this plant, which contains a more violent poison than any other tree of the North American forests.

The fruit of *Hippomane Mancinella* was described by Clusius[1] in 1605, and the earliest authentic botanical description of the tree appeared in Ray's *Historia Plantarum*,[2] published in London in 1688, although references to what was perhaps the Manchineel are found in Dalechamps' *Historia Generalis Plantarum*,[3] published in Leyden in 1586, and in C. Bauhin's *Pinax Theatri Botanici*,[4] published in Bâle in 1623.

Hippomane Mancinella was cultivated in 1739[5] by Philip Miller in the Physic Garden at Chelsea near London, but probably long ago disappeared from gardens.

con ciertas Mançanillas." (Francisco Lopez de Gomara, *Hist. de las Indias*, cap. 46.) See, also, *ibid.* cap. 71.

"Hãno veneno, & q̃sto, è d' una sorte d' arbori della gradezza di pomari & non bisogna se non cogliere il frutto, et ungere la frezza con esso, & se non ha frutti ne rompono un ramo, & con certo latte chi ha, fanno il medesimo." (Alvaro Nunez, *Relatione* [Ramusio, *Navigationi e Viaggi*, iii.].)

"Arbores in hac provincia nostri reperêre dulcium pomorum feraces, sed maximè noxiorum ; in vermes nanque comesa convertunter." (Peter Martyr, *Decades*, ii. lib. i.)

"The mancinel-apple is of a most pleasant sweet smell, of the bigness of a crab, but rank poison, yet the swine and birds have learnt to shun it." (Smith, *Travels, Adventures and Observations*, cap. xxvi.)

"At our first landing on this Island (Santa Cruz) some of our women and men, by eating a small fruit like greene Apples, were fearfully troubled with a sudden burning in their mouthes, and swelling of their tongues so bigge, that some of them could not speake. Also a child by sucking one of those womens breasts, had at that instant his mouth set on such a burning, that it was strange to see how the infant was tormented for the time : but after 24 hours it ware away of itself." (Hakluyt, *Voyages*, ed. Evans, iii. 341 [*Fourth Voyage to Virginia*, anno 1587].)

"Fruticeta item juxta littora nascuntur, quæ poma quædam ferunt piscibus exitiosa si in aquam decidant ; quin & umbra illius fruticis admodum nocet hominibus, si sub illo obdormiverint, Mancanillo vocant." (Jan de Laet, *Nov. Orb.* 2.)

"De nocivis arboribus. Sunt dulcium pomorum feraces, sed maximè noxiorum." (Nieremberg, *Hist. Nat.* lib. xiv. 331.)

Le Mancenilier, Rochefort, *Histoire Naturelle et Morale des Isles Antilles*, 104.

"Il se trouue dans toutes ces isles une seule sorte de pomme, qui a du rapport avec celles de l'Europe. Ces pommes sont toutes semblables aux petites pommes de Paradis ; quoy qu'en effet ce soient du vrayes pommes de l'enfer & de mort, autant dangereuses au corps de ceux qui en mangent, que la pomme d'Adam le fut à son ame." (Du Tertre, *Hist. Gén. des Isles de Saint Christophe*, 254 ; *Hist. Gén. Antill.* ii. 191.)

"Et nommément sur le rivage de la mer il y a force arbrisseaux qui portent les leurs ressemblans presques à nos poires yurees, mais très dangereux à manger." (De Lery, *Hist. d'un Voyage fait en la Terre du Bresil*, 203.)

"La pomme de Mancenille, ou de Macenilier est tout-à-fait semblable à la pomme Dapis pour la couleur, la grosseur & l'odeur. Pour le goût je n'en dirai rien, ma curiosité n'a pas été jusqu'à en faire l'experience." (Labat, *Nouveau Voyage aux Isles de l'Amérique*, i. 474, t.)

[1] *Orbicularis peregrinus fructus nervis distinctus, Exot.* lib. ii. cap. x. 30. — J. Bauhin, *Hist. Gen.* i. lib. iii. 327.

[2] *Arbor venenata Mancinello dicta*, ii. 1646.

Arbor venenata, pomifera, Limoniæ folio Americana, Mancinello dicta, Commelin, *Cat. Hort. Amst.* 35.

Arbor Americana Mancinello dicta, fructu pomi venenato, Plukenet, *Phyt.* t. 142, f. 4 ; *Alm. Bot.* 44.

Juglandi affinis arbor julifera, lactescens, venenata, pyrifolia Mancanillo Hispanis dicta, Sloane, *Cat. Pl. Jam.* 129 ; *Nat. Hist. Jam.* ii. 3, t. 159.

Malus Americana, Laurocerasi folio, venenata. Mancinello arbor seu Massinilia dicta, Commelin, *Hort. Amst.* 131, t. 68.

Mancanilla pyri facie, Plumier, *Nov. Pl. Am. Gen.* 50. — Catesby, *Nat. Hist. Car.* ii. 95, t. 95.

Hippomane foliis ovatis serratis, Linnæus, *Hort. Cliff.* 484. — Royen, *Fl. Leyd. Prodr.* 535.

Hippomane. Arboreum lactescens, ramulis ternatis, petiolis glandula notatis ; floribus spicatis mixtis, Browne, *Nat. Hist. Jam.* 351.

De arboribus venenatis, iv. *Mancanillo*, Jonston, *Hist. Nat. Arb.* (ed. Eckebrecht), ii. 257.

See, also, Jonston, *Dendrographia*, 46, "*Fructus Brasiliensis Mespilo similis.*"

[3] "*Item alia fructum ferens pilæ magnitudine visu speciosum, sed venenatum*," ii. 1834.

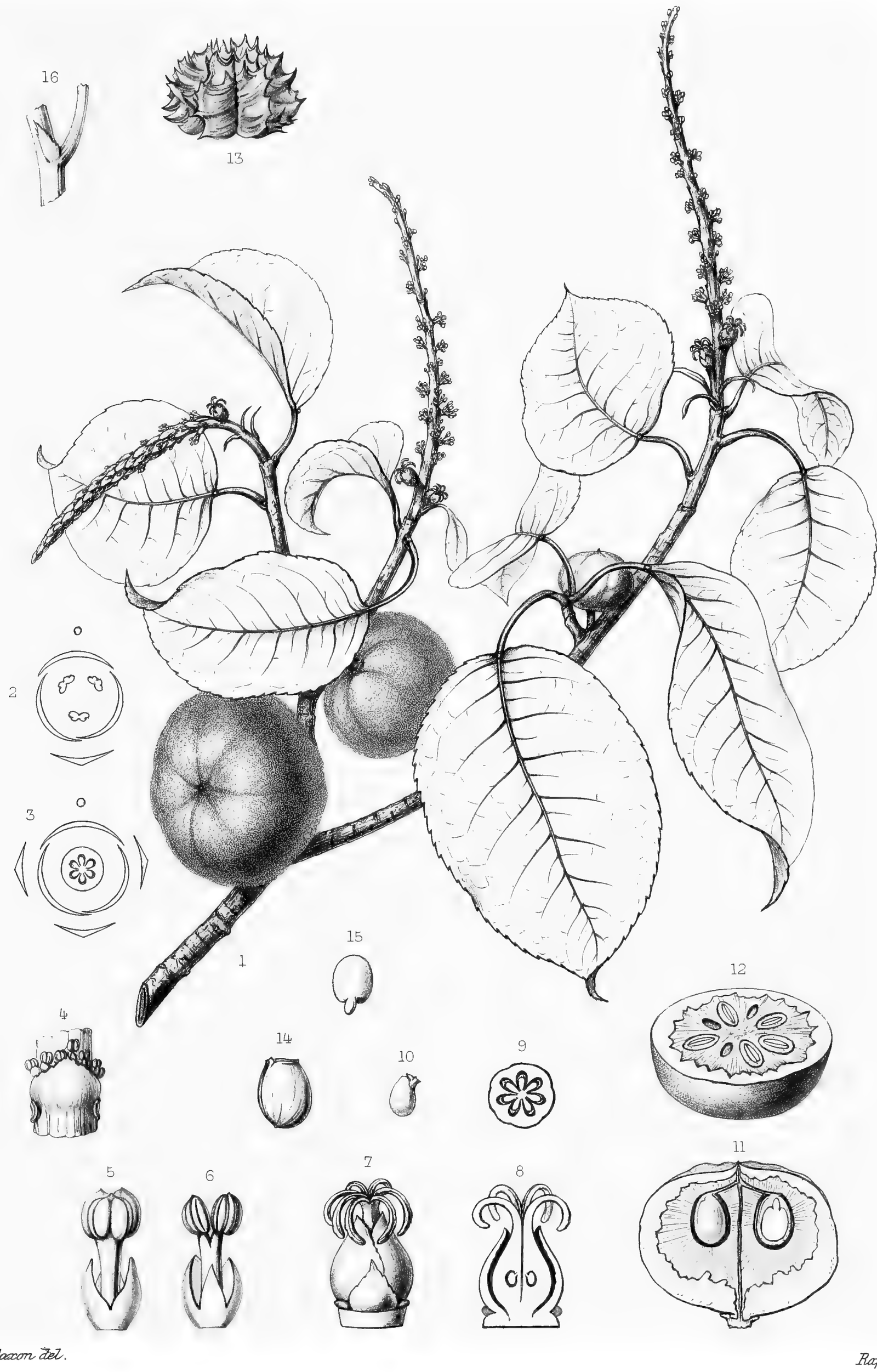
[4] *Mespilo similis fructus venenatus*, 454. *Arbor fructu pilæ magnitudine*, 512.

[5] Aiton, *Hort. Kew.* iii. 378.

EXPLANATION OF THE PLATE.

PLATE CCCX. HIPPOMANE MANCINELLA.

1. A flowering and fruiting branch, natural size.
2. Diagram of a staminate flower.
3. Diagram of a pistillate flower.
4. A cluster of staminate flowers inclosed by their bract, enlarged.
5. A staminate flower, enlarged.
6. A staminate flower, the anthers slightly diverging, enlarged.
7. A pistillate flower, enlarged.
8. Vertical section of a pistillate flower, enlarged.
9. Cross section of an ovary, enlarged.
10. An ovule, much magnified.
11. Vertical section of a fruit, natural size.
12. Cross section of a fruit, natural size.
13. A nutlet, natural size.
14. A seed, enlarged.
15. An embryo, enlarged.
16. Portion of a young branchlet with stipule, enlarged.



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HIPPOMANE MANCINELLA, L

A. Riocreux direx.t

Imp. J. Taneur, Paris.

ULMUS.

FLOWERS perfect or rarely polygamous; calyx 4 to 9-lobed, the lobes imbricated in æstivation; corolla 0; stamens 4 to 9, erect before anthesis; disk 0; ovary superior, 1 or rarely 2-celled; ovule solitary, suspended. Fruit a compressed samara, peripterous. Leaves alternate, 2-ranked, deciduous or sub-persistent, furnished with stipules.

Ulmus, Linnæus, *Gen.* 68 (1737). — Adanson, *Fam. Pl.* ii. 377. — A. L. de Jussieu, *Gen.* 408. — Endlicher, *Gen.* 276. — Meisner, *Gen.* 351. — Baillon, *Hist. Pl.* vi. 184. — Bentham & Hooker, *Gen.* iii. 351. — Pax, *Engler & Prantl Pflanzenfam.* iii. pt. i. 62.

Microptelea, Spach, *Ann. Sci. Nat.* sér. 2, xv. 358 (1841). — Endlicher, *Gen.* Suppl. ii. 29. — Meisner, *Gen.* ii. 370.

Chætoptelea, Liebmann, *Vidensk. Medd. fra nat. For. Kjöbenh.* 1850, 76.

Trees or rarely shrubs, with watery juice, deeply furrowed bark, slender terete unarmed slightly zigzag branchlets often furnished with corky wings, and fibrous roots. Leaf-buds[1] formed early in the season in the axils of leaves of the year, covered with numerous ovate rounded chestnut-brown glabrous puberulous or hirsute scales closely imbricated in two ranks, increasing in size from without inward; scales of the outer rows sterile; those of the inner rows accrescent, replacing the stipules of the first leaves, deciduous, marking the base of the branchlet in falling with persistent ring-like scars. Leaves conduplicate in vernation, alternate, two-ranked, petiolate, simply or doubly serrate, penniveined, deciduous or rarely subpersistent; stipules lateral, linear-lanceolate to obovate, entire, free or connate at the base, scarious, inclosing the leaf in the bud, caducous. Inflorescence-buds[2] axillary near the ends of the branches, similar to but rather larger than the leaf-buds, the outer scales sterile, the inner bearing flowers and rarely leaves. Flowers, perfect in the American species, minute, articulate on slender bibracteolate pedicels produced from the axils of linear acute scarious bracts in pedunculate or subsessile fascicles or cymes, appearing in early spring before the leaves in the axils of those of the previous year or autumnal in the axils of leaves of the year. Calyx campanulate, four to nine, usually five-lobed, membranaceous, marcescent. Stamens as many as and opposite the lobes of the calyx, hypogynous; filaments filiform or slightly flattened, erect in the bud, exserted after anthesis; anthers oblong, emarginate, subcordate at the base, attached on the back below the middle, extrorse, two-celled, the cells opening longitudinally. Ovary sessile or stipitate, compressed, glabrous or hirsute, crowned with a simple deeply two-lobed style, the spreading lobes papillo-stigmatic on the inner face, usually one-celled by abortion, rarely two-celled; effete or rudimentary in the staminate flower; ovule solitary, suspended from the apex of the cell, amphitropous; micropyle extrorse, superior. Fruit ovate or oblong, often oblique, sessile or stipitate, surrounded at the base by the remnants of the calyx, membranaceous; seminal cavity compressed, slightly thickened on the margin, chartaceous, produced into a thin reticulate-venulose membranaceous light brown broad or rarely narrow wing naked or ciliate on the margin,

[1] Ulmus does not form a terminal bud, the end of the branch dying and dropping off early in the season, leaving a small nearly orbicular pale scar by the side of the upper axillary bud which prolongs the branch the following spring (Foerste, *Bot. Gazette*, xvii. 184, t. 12, f. 3; *Bull. Torrey Bot. Club*, xix. 268, t. 132, f. 8; xx. 162, t. 147, f. 8, 10).

[2] Henry, *Nov. Act. Cur.* xxii. 307, t. 28. — Hitchcock, *Trans. St. Louis Acad.* vi. 137; *The Woody Plants of Manhattan in their Winter Condition*, 16.

tipped with or inclosing the remnants of the persistent style and sometimes marked horizontally by the thickened line of union of the two carpels. Seed ovate, compressed, marked on the ventral edge with the thin raphe, solitary, suspended from the apex of the cell, destitute of albumen; testa membranaceous, light or dark chestnut-brown, of two coats, rarely produced into a narrow wing. Embryo erect; cotyledons flat or slightly convex, fleshy, much longer than the superior radicle turned toward the oblong linear pale hilum.[1]

Ulmus, of which fifteen or sixteen species can be distinguished, is widely distributed through the boreal and temperate regions of the northern hemisphere, with the exception of western North America, where no Elm-tree is found, reaching in the New World the mountains of southern Mexico, upon which one species[2] occurs, and in the Old World the subtropical forests of the Sikkim Himalaya, the home of *Ulmus lancifolia*.[3] The forests of eastern North America contain five species; in Europe three species occur; of these two, *Ulmus campestris*[4] and *Ulmus scabra*,[5] range through the northern, central, and southern parts of the continent, extending to the mountains of northern Africa, to the Caucasus, Persia, and Turkestan, and through Siberia, Manchuria, and northern China to Japan; the third European species[6] is confined to the central and southeastern portions of the continent and to

[1] By Planchon (*Ann. Sci. Nat.* sér. 3, x. 260) Ulmus has been divided into the following subgenera: —

Oreoptelea (Spach, *Ann. Sci. Nat.* sér. 2, xv. 363). Flowers vernal, appearing before the leaves; pedicels subcymose or fascicled, elongated; perianth lobed scarcely to the middle. Fruit densely ciliate on the margins. Leaves deciduous.

Dryoptelea (Spach, *l. c.* 361). Flowers vernal, appearing before the leaves; pedicels closely fascicled, abbreviated; perianth lobed scarcely to the middle. Fruit naked on the margins. Leaves deciduous.

Microptelea (Spach, *l. c.* 358). Flowers autumnal in the axils of leaves of the year; pedicels fascicled, more or less abbreviated; perianth divided to below the middle. Fruit ciliate or naked on the margins. Leaves subpersistent or tardily deciduous.

[2] *Ulmus Mexicana*, Planchon, *De Candolle Prodr.* xvii. 156 (1873). — Hemsley, *Bot. Biol. Am. Cent.* iii. 138.

Chætoptelea Mexicana, Liebmann, *Vidensk. Med. fra nat. For. Kjöbenh.* 1850, 76; *Dansk. Vidensk. Selsk. Skrift.* ser. 5, ii. 336. — Walpers, *Ann.* iii. 427.

[3] Roxburgh, *Fl. Ind.* ed. 2, ii. 66 (1832). — Wallich, *Pl. As. Rar.* ii. 86, t. 200. — Planchon, *Ann. Sci. Nat.* sér. 3, x. 281; *De Candolle Prodr. l. c.* 162. — Kurz, *Forest Fl. Brit. Burm.* ii. 473. — Gamble, *Man. Indian Timbers*, 342. — Hooker f. *Fl. Brit. Ind.* v. 480. — Forbes & Hemsley, *Jour. Linn. Soc.* xxvi. 447.

Ulmus Hookeriana, Planchon, *De Candolle Prodr. l. c.* (1873).

[4] Linnæus, *Spec.* 225 (in part) (1753). — Sowerby, *English Bot.* xxvii. 1886, t. 1886. — Planchon, *Ann. Sci. Nat. l. c.* 272; *De Candolle Prodr. l. c.* 156. — Maximowicz, *Bull. Acad. Sci. St. Pétersbourg*, xviii. 290 (*Mél. Biol.* ix. 22). — Koch, *Dendr.* ii. 405. — Boissier, *Fl. Orient.* iv. 1157. — Franchet, *Ann. Sci. Nat.* sér. 6, xviii. 250 (*Pl. Turkestan*); *Nouv. Arch. Mus.* sér. 2, v. 268 (*Pl. David.* i.). — Dippel, *Handb. Laubholzk.* ii. 22. — Forbes & Hemsley, *l. c.* 446.

Ulmus glabra, Miller, *Dict.* ed. 8, No. 4 (1758). — Loudon, *Arb. Brit.* iii. 1403. — Dippel, *l. c.* 25.

Ulmus sativa, Du Roi, *Harbk. Baumz.* ii. 502 (1772).

Ulmus suberosa, Moench, *Bäume Weiss.* 136 (1785). — Ehrhart, *Beitr.* vi. 87. — Willdenow, *Berl. Baumz.* 391; *Spec.* i. pt. ii. 1324. — Sowerby, *l. c.* xxxi. 2161, t. 2161.

Ulmus foliacea, Gilibert, *Phytolog.* ii. 395 (1792).

Ulmus tetrandra, Schkuhr, *Handb.* i. 178, t. 57 (1808).

Ulmus vulgaris, Dumortier, *Fl. Belg.* 25 (1827).

This is the common Elm-tree of Europe, usually called English Elm in the United States, although now not believed to be a native of England, where it was probably carried by the Romans. (See Bentham, *Ill. Handb. Brit. Fl.* ii. 746.) For centuries it has been planted in Europe as an ornament to parks and gardens and as a timber-tree; it was brought to New England during the first century of the colony on Massachusetts Bay, and vigorous specimens in the neighborhood of Boston more than a hundred and fifty years old show that it is better adapted to the climate of eastern North America than many other European trees (Sargent, *Rep. Sec. Mass. Board Agric.* xxv. 24). In European nurseries a number of forms of this tree, which shows a remarkable tendency to seminal variation, peculiar in habit or in the form and coloring of their leaves, have appeared and are often planted by the lovers of curious trees or for timber (Loudon, *l. c.* 1375, 1395. — Planchon, *l. c.*).

[5] Miller, *l. c.* No. 2 (1758). — Koch, *Dendr. l. c.* 412. — Dippel, *l. c.* 27.

Ulmus campestris, Linnæus, *l. c.* (in part) (1753).

Ulmus montana, Withering, *Arr. Bot. Veg. Gr. Brit.* ii. 279 (1776). — Sowerby, *l. c.* xvii. 1887, t. 1887. — Planchon, *Ann. Sci. Nat. l. c.* 274; *De Candolle Prodr. l. c.* 159. — Boissier, *l. c.* 1158. — Franchet & Savatier, *Enum. Pl. Jap.* i. 431. — Forbes & Hemsley, *l. c.* 448.

Ulmus Hollandica, Pallas, *Fl. Ross.* i. 77 (not Miller) (1784).

Ulmus nuda, Ehrhart, *l. c.* 86 (1791).

Ulmus excelsa, Borkhausen, *Handb. Forstbot.* i. 839 (1800).

As an ornamental tree the Wych or Dutch Elm with its numerous seminal varieties produced in cultivation (Loudon, *l. c.* 1398) is planted in parks and gardens in all the countries of northern and central Europe, and in the eastern United States, where it is less commonly seen than *Ulmus campestris*, and where it now sometimes springs up spontaneously.

In the island of Yeso the Ainos weave a strong durable cloth from the inner bark of a variety of this tree (var. *laciniata*, Maximowicz, *Prim. Fl. Amur.* 246), which is common in the forests which cover the mountains in the interior of the island (Rein, *Industries of Japan*, 169. — Sargent, *Forest Fl. Japan*, 57).

[6] *Ulmus lævis*, Pallas, *Fl. Ross.* i. 75, t. 48, F. (1784). — Koch, *l. c.* 419.

Ulmus pedunculata, Fourgeroux, *Mém. Acad. Sci.* 1784, 211,

the Caucasus. One species [1] inhabits the western Himalaya from Nepaul to Cashmere; and another [2] Thibet and northern China, where two or three others still imperfectly known have been discovered.[3] The type is an ancient one,[4] its traces existing in the early tertiary rocks of Greenland; before the glacial period it long inhabited Europe, western Asia, and North America, where it abounded on the mid-continental plateau,[5] and ranged westward to the shores of the Pacific Ocean.[6]

Ulmus produces heavy, hard, tough, and sometimes strong light-colored wood often difficult to split, containing in the American species concentric circles of irregularly arranged groups of small open ducts. The mucilaginous inner bark of the branches of the North American *Ulmus fulva* is used medicinally; and the tough inner bark of some of the species is made into rope or woven into coarse cloth. In China a nourishing white mucilaginous meal is made from the inner bark of Elm-trees and used as food by the mountaineers of the northern provinces, and in the composition of incense sticks; the fruit is employed in medicine, and the bark and young fruits are eaten in periods of severe famine.[7]

In all temperate and boreal regions of North America and Europe Elm-trees are planted for shade and ornament, particularly *Ulmus Americana*, *Ulmus alata*, and *Ulmus crassifolia* in North America, and *Ulmus campestris*, *Ulmus scabra*, and *Ulmus lævis* in Europe.

In North America Ulmus is preyed upon by many insects,[8] which in some parts of the country often

t. 2 (1787). — Planchon, *Ann. Sci. Nat.* sér. 3, x. 267; *De Candolle Prodr.* xvii. 154. — Dippel, *Handb. Laubholzk.* ii. 32.

Ulmus effusa, Willdenow, *Berl. Baumz.* 393 (1796); *Spec.* i. pt. ii. 1325. — Loudon, *Arb. Brit.* iii. 1397.

Ulmus ciliata, Ehrhart, *Beitr.* 88 (1791).

Ulmus octandra, Schkuhr, *Handb.* i. 178, t. 57 (1791).

[1] *Ulmus Wallichiana*, Planchon, *Ann. Sci. Nat. l. c.* 277 (1848); *De Candolle Prodr. l. c.* 158. — Brandis, *Forest Fl. Brit. Ind.* 432, t. 51. — Gamble, *Man. Indian Timbers*, 341. — Hooker f. *Fl. Brit. Ind.* v. 480.

Ulmus campestris, Brandis, *l. c.* 433 (not Linnæus) (teste Hooker f. *l. c.*) (1874).

[2] *Ulmus parvifolia*, Jacquin, *Hort. Schœnbr.* iii. 6, t. 262 (1798). — Planchon, *Ann. Sci. Nat. l. c.* 280; *De Candolle Prodr. l. c.* 161. — Brandis, *l. c.* 434. — Maximowicz, *Bull. Acad. Sci. St. Pétersbourg*, xviii. 292 (*Mél. Biol.* ix. 25). — Franchet & Savatier, *Enum. Pl. Jap.* i. 431. — Hooker f. *l. c.* 481. — Forbes & Hemsley, *Jour. Linn. Soc.* xxvi. 448.

Ulmus Chinensis, Persoon, *Syn.* i. 291 (1805).

Planera parvifolia, Sweet, *Hort. Brit.* ed. 2, 464 (1830).

Ulmus virgata, Roxburgh, *Fl. Ind.* ed. 2, 67 (1832).

Ulmus campestris, parvifolia, Loudon, *l. c.* 1377 (1838).

Ulmus campestris, Chinensis, Loudon, *l. c.* (1838).

Microptelea parvifolia, Spach, *Ann. Sci. Nat.* sér. 2, xv. 359 (1841).

This handsome small tree is often planted in temple grounds in Japan, where it was probably carried from China by Buddhist priests; in the United States it is occasionally cultivated in the neighborhood of New York and Boston, where it is hardy and apparently perfectly at home (*Garden and Forest*, i. 231, 312).

[3] Hance, *Jour. Bot.* vi. 332. — Maximowicz, *l. c.* 289 (*l. c.* 22). — Franchet, *Nouv. Arch. Mus.* sér. 2, v. 236 (*Pl. David.* i.). — Forbes & Hemsley, *l. c.* 446.

[4] Saporta, *Origine Paléontologique des Arbres*, 212, f. 25. — Zittel, *Handb. Palæontolog.* ii. 472, f. 280, 1–13.

[5] Lesquereux, *U. S. Geolog. Surv.* vii. 187, t. 26, f. 1–3; viii. 160 (*Contrib. Foss. Fl. Western Territories*, ii., iii.). — L. F. Ward, *Ann. Rep. U. S. Geolog. Surv.* 1884–85, 552, t. 46, f. 1–6 (*Syn. Fl. Laramie Group*).

[6] Lesquereux, *l. c.* 260, 265, t. 45, B. f. 3, 4, 7; *Mem. Mus. Comp. Zoöl.* vi. pt. ii. 15, t. 4, f. 1; t. 6, f. 7ª (*Fossil Plants of the Auriferous Gravel Deposit of the Sierra Nevada*).

[7] Bretschneider, *Jour. North-China Branch Roy. Asiatic Soc.* n. ser. xxv. 128, 365 (*Botanicon Sinicum*, ii.). — Smith, *Chinese Mat. Med.* 92).

[8] While many species of insects feed upon Ulmus in North America, the greatest injury is caused by a comparatively few kinds which are most abundant on and often particularly destructive to trees planted for shade or ornament. Packard (*Fifth Rep. U. S. Entomolog. Comm.*) enumerates seventy-two species as occurring on the Elm in the United States, and this number could probably be now largely increased.

Saperda tridentata, Olivier, whose larvæ cause great destruction by boring into the living trees, especially in some of the western cities, is one of the most dangerous species infesting the wood of Elm-trees. An imported moth, *Zeuzera pyrina*, Fabricius, appears to be destructive to Elms in New Jersey and New York, where it has now become established (J. B. Smith, *Garden and Forest*, iii. 30). The most dangerous foliage-destroying insects to Elms are the canker-worms, *Paleacrita vernata*, Peck, and *Eugonia subsignaria*, Hübner, and an imported Elm-leaf Beetle, *Galeruca xanthomelæna*, Schrank. The larvæ of the first often defoliate Elms and other trees in the eastern and middle states, and banding the trees with cloth covered with printers' ink or other sticky matter is commonly practiced in order to prevent the ascent of the wingless female moths. The Elm-leaf beetle, imported from Europe more than half a century ago, is now spread over a wide area, and is often very destructive (*Bull.* 10, *Division of Entomology, U. S. Dept. Agric.* 1887–88). The Fall Web-worm, *Hyphantria cunea*, Drury, is often abundant on Elms, and the White-spotted Tussock Moth, *Orgyia leucostigma*, Abbot & Smith, is occasionally troublesome, especially in some of the New England cities. Among sucking insects the Cockscomb Gall-louse, *Colopha Ulmicola*, Fitch, produces conspicuous galls on the upper surface of the leaves, and *Tetraneura Ulmi*, Linnæus, causes the growth of large galls which are more or less club-shaped. *Schizoneura Americana*, Riley, often causes the leaves to become curled, gnarled, and discolored; and *Pemphigus ulmifusus*, Walsh, also affects these trees. *Gossyparia Ulmi*, Geoffroy, recently

disfigure the foliage and destroy the ornamental value of Elm-trees; and is subject to numerous fungal diseases.[1]

Elm-trees can be easily raised from seeds, which germinate as soon as they are ripe; they can be multiplied by shoots which in some species are produced in great numbers from the roots, and the seminal varieties can be propagated by grafting.

Ulmus, the classical name of the Elm-tree, was adopted by Tournefort,[2] and afterward by Linnæus, as the name of the genus.

imported from Europe, has already become widely spread. It obtains its food chiefly through the bark of the trees, which often acquires a black appearance from the excretions or honey dew of the insects (L. O. Howard, *Insect Life*, ii. 1889, 34. — J. G. Jack, *Garden and Forest*, ii. 461, f. 129; iv. 184). Other plant lice and scale insects affect the Elm sometimes injuriously. A mite, *Phytoptus Ulmi*, Garman, produces minute club-shaped galls on the leaves, and the fruit is sometimes infested by a small beetle belonging to the Curculio family.

[1] The most serious fungal disease of Ulmus in North America is caused by *Phleospora Ulmi*, Wallri, which is sometimes very abundant in the eastern states, especially on foreign species, although it also occurs on *Ulmus Americana*. The disease, which was probably imported from Europe many years ago, covers the leaves in the late summer with many small spots, from which exude in damp weather rose-colored gelatinous masses. The diseased leaves fall prematurely, and the fungus continues to develop after they have reached the ground, appearing in its mature state only at the end of winter. This disease, which is sporadic in its habit and occurs only in limited areas, sometimes does considerable damage. *Massaria Ulmi*, Fuckel, which is also European and is usually confined to foreign species, is occasionally found on the American Elms; it attacks the twigs and younger branches, where it appears in the form of small scattered black papillæ which soon break up when the bark becomes of a sooty black color. This disease appears to be perennial and extends from branch to branch, disfiguring and often killing the trees.

Ulmus is infested by certain characteristic leaf mildews. *Uncinula macrospora*, Peck, is found on *Ulmus Americana*, *Ulmus alata*, and *Ulmus fulva;* and *Uncinula intermedia*, Berkeley & Curtis, also occurs on the leaves of *Ulmus alata*. Among edible fungi, *Agaricus ulmarius*, Bulliard, one of the lateral edible fungi, is not uncommon on the large branches of Elms in thickly settled districts. *Panus dealbatus*, Berkeley, is sometimes found on Elm-trees, and the characteristic *Polyporus conchifer*, Schweinitz, abounds on the older limbs of *Ulmus Americana*, appearing in the form of small disks or flat cups which are usually more or less confluent with concentric zones of the white and dark gray colors characteristic of this species.

[2] *Inst.* 601, t. 372.

CONSPECTUS OF THE NORTH AMERICAN SPECIES.

Flowers vernal, appearing before the leaves.
- Flowers on slender drooping pedicels; fruit ciliate on the margins.
  - Bud-scales glabrous; branchlets destitute of corky wings; fruit glabrous; leaves obovate-oblong to oval, usually smooth on the upper, soft-pubescent on the lower surface . . . . 1. U. AMERICANA.
  - Bud-scales puberulous; branches often furnished with corky wings; fruit hirsute; leaves obovate to oblong-oval, smooth on the upper, soft-pubescent on the lower surface . . . . 2. U. RACEMOSA.
  - Bud-scales glabrous or slightly puberulous; branchlets furnished with broad corky wings; fruit hirsute; leaves ovate-oblong to oblong-lanceolate, smooth on the upper, soft-pubescent on the lower surface . . . . . 3. U. ALATA.
- Flowers on short pedicels; fruit naked on the margins.
  - Bud-scales coated with rusty hairs; branchlets destitute of corky wings; fruit pubescent; leaves ovate-oblong, scabrous on the upper, pubescent on the lower surface . . . . . 4. U. FULVA.

Flowers autumnal, appearing in the axils of leaves of the year on short pedicels.
- Bud-scales puberulous; branchlets furnished with corky wings; fruit hirsute; leaves ovate, scabrous on the upper, soft-pubescent on the lower surface . . . . . 5. U. CRASSIFOLIA.

ULMUS AMERICANA.

White Elm. Water Elm.

FLOWERS on long drooping pedicels. Fruit glabrous, ciliate on the margins. Leaves obovate-oblong to oval, usually smooth on the upper, soft-pubescent on the lower surface. Bud-scales glabrous. Branchlets destitute of corky wings.

Ulmus Americana, Linnæus, *Spec.* 226 (1753). — Du Roi, *Harbk. Baumz.* ii. 506. — Wangenheim, *Beschreib. Nordam. Holz.* 121; *Nordam. Holz.* 46. — Walter, *Fl. Car.* 111. — Schkuhr, *Handb.* i. 179. — Willdenow, *Berl. Baumz.* 394; *Spec.* i. pt. ii. 1325; *Enum.* 295. — *Nouveau Duhamel*, ii. 147. — Castiglioni, *Viag. negli Stati Uniti*, ii. 396. — Borkhausen, *Handb. Forstbot.* i. 857. — Michaux, *Fl. Bor.-Am.* i. 173. — Persoon, *Syn.* i. 291. — Desfontaines, *Hist. Arb.* ii. 442. — Stokes, *Bot. Mat. Med.* ii. 34. —Michaux f. *Hist. Arb. Am.* iii. 269, t. 4. —Bigelow, *Fl. Boston.* 66. — Pursh, *Fl. Am. Sept.* i. 199. — Nuttall, *Gen.* i. 201. — Roemer & Schultes, *Syst.* vi. 300. — Elliott, *Sk.* i. 333. — Hayne, *Dendr. Fl.* 31. — Schmidt, *Oestr. Baumz.* iv. 46, t. 230. — Sprengel, *Syst.* i. 930. — Rafinesque, *New Fl.* iii. 39. — Hooker, *Fl. Bor.-Am.* ii. 142. — Dietrich, *Syn.* ii. 992. — Spach, *Ann. Sci. Nat.* sér. 2, xv. 364; *Hist. Vég.* xi. 108. — Torrey, *Fl. N. Y.* ii. 165. — Planchon, *Ann. Sci. Nat.* sér. 3, x. 268; *De Candolle Prodr.* xvii. 155. — Walpers, *Ann.* iii. 424. — Richardson, *Arctic Exped.* ii. 308. — Darlington, *Fl. Cestr.* ed. 3, 255. — Curtis, *Rep. Geolog. Surv. N. Car.* 1860, iii. 54. — Chapman, *Fl.* 416. — Koch, *Dendr.* ii. 421. — Emerson, *Trees Mass.* ed. 2, ii. 322, t. — Koehne, *Deutsche Dendr.* 136, f. 27, J. — Ridgway, *Proc. U. S. Nat. Mus.* 1882, 71. — Lauche, *Deutsche Dendr.* 348. — Sargent, *Forest Trees N. Am.* 10*th Census U. S.* ix. 123. — Watson & Coulter, *Gray's Man.* ed. 6, 462. — Dippel, *Handb. Laubholzk.* ii. 32, f. 10. — Coulter, *Contrib. U. S. Nat. Herb.* ii. 406 (*Man. Pl. W. Texas*).

Ulmus mollifolia, Marshall, *Arbust. Am.* 156 (1783).

Ulmus Americana, β alba, Aiton, *Hort. Kew.* i. 320 (1789). — Stokes, *Bot. Mat. Med.* ii. 35.

Ulmus Americana, γ pendula, Aiton, *Hort. Kew.* i. 320 (1789). — Spach, *Ann. Sci. Nat.* sér. 2, xv. 364; *Hist. Vég.* xi. 109.

? Ulmus tomentosa, Borkhausen, *Handb. Forstbot.* i. 856 (1800).

Ulmus pendula, Willdenow, *Berl. Baumz.* ed. 2, 519 (1811). — Du Mont de Courset, *Bot. Cult.* ed. 2, vi. 385. — Hayne, *Dendr. Fl.* 33.

? Ulmus obovata, Rafinesque, *New Fl.* iii. 39 (1836).

Ulmus alba, Rafinesque, *Fl. Ludovic.* 115 (1817); *New Fl.* iii. 38.

? Ulmus dentata, Rafinesque, *New Fl.* iii. 39 (1836).

Ulmus Americana, β scabra, Spach, *Ann. Sci. Nat.* sér. 2, xv. 364 (1841); *Hist. Vég.* xi. 109. — Walpers, *Ann.* iii. 424.

Ulmus Americana, α glabra, Walpers, *Ann.* iii. 424 (1852).

Ulmus Americana, γ ? Bartramii, Walpers, *Ann.* iii. 424 (1852).

Ulmus Americana, var. ? aspera, Chapman, *Fl.* 416 (1865).

Ulmus Floridana, Chapman, *Fl.* 416 (1865).

A tree, sometimes one hundred to one hundred and twenty feet in height, with a tall trunk six to eleven feet in diameter, frequently enlarged at the base into great buttresses, occasionally rising with a straight undivided shaft to the height of sixty or eighty feet, and separating into short spreading branches, or more commonly dividing, thirty to fifty feet above the ground, into numerous upright limbs, which, gradually spreading, form a broad inversely conical round-topped head of long pendulous graceful branches, often one hundred and occasionally one hundred and forty feet in diameter, and slender branchlets which not infrequently also fringe the trunk and its principal divisions. The bark of the trunk is an inch to an inch and a half in thickness, and is ashy gray, and irregularly divided by deep fissures into broad ridges separating on the surface into thin appressed scales. The branchlets, when they first appear, are light green, and coated with soft pale pubescence, which usually soon disappears, and in their first winter are light reddish brown, glabrous, or sometimes puberulous, and marked with scattered pale lenticels, and with large elevated semiorbicular leaf-scars in which appear the ends of three large equidistant fibro-vascular bundles; later they become dark reddish brown, and finally ashy gray. The buds are ovate, acute, slightly flattened by the pressure of the stem, an eighth

of an inch long, and covered with broadly ovate rounded bright chestnut-brown glabrous scales; the inner scales are bright green and glabrous, ovate, acute, and often on vigorous shoots nearly an inch long and a quarter of an inch broad, and gradually pass into the stipules of the later leaves. The leaves are obovate-oblong to oval, abruptly narrowed at the apex into long points, full and rounded at the base on one side, and shorter and wedge-shaped on the other, and coarsely and doubly serrate with slightly incurved teeth; when they unfold they are coated on the lower surface with pale pubescence, and are pilose on the upper surface with long scattered white hairs, and at maturity are four to six inches long, one to three inches wide, dark green and glabrous or scabrate above, and pale and soft-pubescent or sometimes glabrous below, with narrow pale midribs slightly impressed on the upper side, and many slender straight primary veins running to the points of the teeth and connected by fine cross veinlets barely distinguishable on the upper surface; they are borne on stout petioles a quarter of an inch in length, and turn bright clear yellow in the early autumn before falling. The stipules are linear-lanceolate, half an inch to two thirds of an inch long, caducous, light green, or on the latest leaves white and scarious. The inflorescence-buds are produced in the axils of several of the upper leaves of the previous year, and are slightly larger than the leaf-buds; from the axils of the seven or eight inner scales, which are ciliate on the margins, and furnished at the apex with tufts of long soft white hairs, the three or four-flowered short-stalked fascicles of flowers are produced on long slender drooping pedicels sometimes an inch in length, those of the lateral flowers of the clusters being furnished at the base with acute scarious bracts half an inch long, and two minute bractlets hairy at the apex. The calyx, which is irregularly divided into seven to nine rounded lobes ciliate on the margins, and is often somewhat oblique, is puberulous on the outer surface, and green tinged with red above the middle, becoming chestnut-brown in fading. The stamens are exserted, with slightly flattened pale filaments and bright red anthers which shed their pollen before the stigmas mature. The ovary is light green, ciliate on both margins with long white hairs, and is crowned with light green styles covered on their stigmatic surface with white papillæ. The fruit ripens as the leaves unfold, hanging on its long stems in crowded clusters, and is ovate or obovate-oblong, slightly stipitate, conspicuously reticulate-venulose, half an inch long, and ciliate on the margins, the sharp points of the wing being incurved, and inclosing the deep notch.

In British America *Ulmus Americana* is distributed from southern Newfoundland to the northern shores of Lake Superior and the eastern base of the Rocky Mountains, where it ascends the Saskatchewan to latitude 54° 30″ north;[1] it ranges south to Cape Canaveral and the shores of Pease Creek in Florida, and westward in the United States to the Black Hills of Dakota,[2] western Nebraska,[3] western Kansas,[4] the Indian Territory, and the valley of the Rio Concho in Texas.[5] Less abundant and of smaller size in the south, in the north *Ulmus Americana* is one of the commonest inhabitants of the forests which still cover river bottom-lands, intervales, and low rich hills, and on the mid-continental plateau, with the Box Elder, the Green Ash, and the Cottonwood, it lines the banks of streams with a fringe of verdure.

The wood of *Ulmus Americana* is heavy, hard, strong, tough, difficult to split, and rather coarse-grained; it contains numerous thin medullary rays and rows of many large open ducts, clearly marking the layers of annual growth, and is light brown, with thick somewhat lighter colored sapwood. The specific gravity of the absolutely dry wood is 0.6506, a cubic foot weighing 40.55 pounds. It is largely used for the hubs of wheels, for saddle-trees, in flooring and cooperage, and in boat and ship building. The bark was used by the Indians, when they could not procure Birch bark, in making their canoes;[6] and in some parts of the country whites and Indians twisted the tough inner bark into ropes.[7]

[1] Brunet, *Cat. Vég. Lig. Can.* 44. — Bell, *Geolog. Rep. Canada*, 1879–80, 48°. — Macoun, *Cat. Can. Pl.* 428.

[2] Winchell, *Ludlow Rep. Black Hills, Dakota*, 68.

[3] Bessey, *Rep. Nebraska State Board of Agric.* 1894, 104.

[4] Mason, *Rep. upon the Variety and Distribution of Kansas Trees*, 10.

[5] Havard, *Proc. U. S. Nat. Mus.* viii. 506.

[6] Kalm, *Travels*, English ed. ii. 298.

[7] Lawson, *History of Carolina*, 93.

The White Elm is one of the largest and most graceful trees of the northeastern states and Canada. It is beautiful at all seasons of the year; when its minute flowers, harbingers of earliest spring, cover the branches; when in summer it rises like a great fountain of dark and brilliant green above its humbler companions of the forest, or sweeps with long and graceful boughs the placid waters of some stream flowing through verdant meadows; when autumn delicately tints its leaves, and when winter brings out every detail of the great arching limbs and slender pendulous branches standing out in clear relief against the sky.

The Elm-trees which greeted the English colonists as they landed on the shores of New England seemed like old friends from their general resemblance to the Elm-trees that had stood by their cottages at home; and as the forest gave way to corn-fields many Elm-trees were allowed to escape the axe, and when a home was made a sapling Elm taken from the borders of a neighboring swamp was often set to guard the roof-tree. These Elm-trees, remnants of the forests which covered New England when it was first inhabited by white men, or planted during the first century of their occupation, are now dead or rapidly disappearing; they long remained the noblest and most imposing trees of the northern states, and no others planted by man in North America have equaled the largest of them in beauty and size.[1]

The White Elm[2] has always been the favorite ornamental tree in the northern states, where it has been used more often than any other to shade city streets and country roadsides, to decorate parks, and to embower mansions and cottages in verdure. In such situations it does not always flourish, and unless provided with good soil and abundant moisture, which are essential to its welfare, and with careful and constant protection from the insects which devour its foliage, the White Elm is not a handsome or successful tree; and it should be cautiously used in street planting.

Ulmus Americana was first described by Clayton in the *Flora Virginica*,[3] and was cultivated in England by Mr. James Gordon[4] as early as the middle of the eighteenth century;[5] it is still occasionally seen in European collections, although beyond the boundaries of its native land it does not grow to a great size or display much beauty. An unusually variable tree in habit and in the size and shape of its leaves, *Ulmus Americana* has not produced in cultivation such abnormal forms as have been derived from some of the Old World species. The most remarkable is one with long and unusually pendulous branches which was discovered a few years ago in the woods of Illinois, and is now propagated by nurserymen.[6]

[1] Emerson, *Trees of Massachusetts*, 290. — J. C. Warren, *The Great Tree on Boston Common.* — Piper, *The Trees of America*, 42. — Buckley, *Am. Jour. Sci.* ser. 2, xiii. 398. — Oliver Wendell Holmes, *The Autocrat of the Breakfast-Table*, chap. x. — Dame & Brooks, *Typical Elms and other Trees of Massachusetts.* — *Garden and Forest*, iii. 287, 443, 467; v. 307; vi. 175.

[2] *Ulmus Americana* is also known as the American Elm and Swamp Elm, and sometimes as the Rock Elm, although this name is most often applied to *Ulmus racemosa*.

[3] *Ulmus procerior foliis angustioribus, trunco per intervalla viminibus dense congestis infra ramos obsito*, 146.

Ulmus Americana, Colden, *Act. Hort. Ups.* 1743, 99 (*Pl. Novebor.*).

[4] See i. 40.

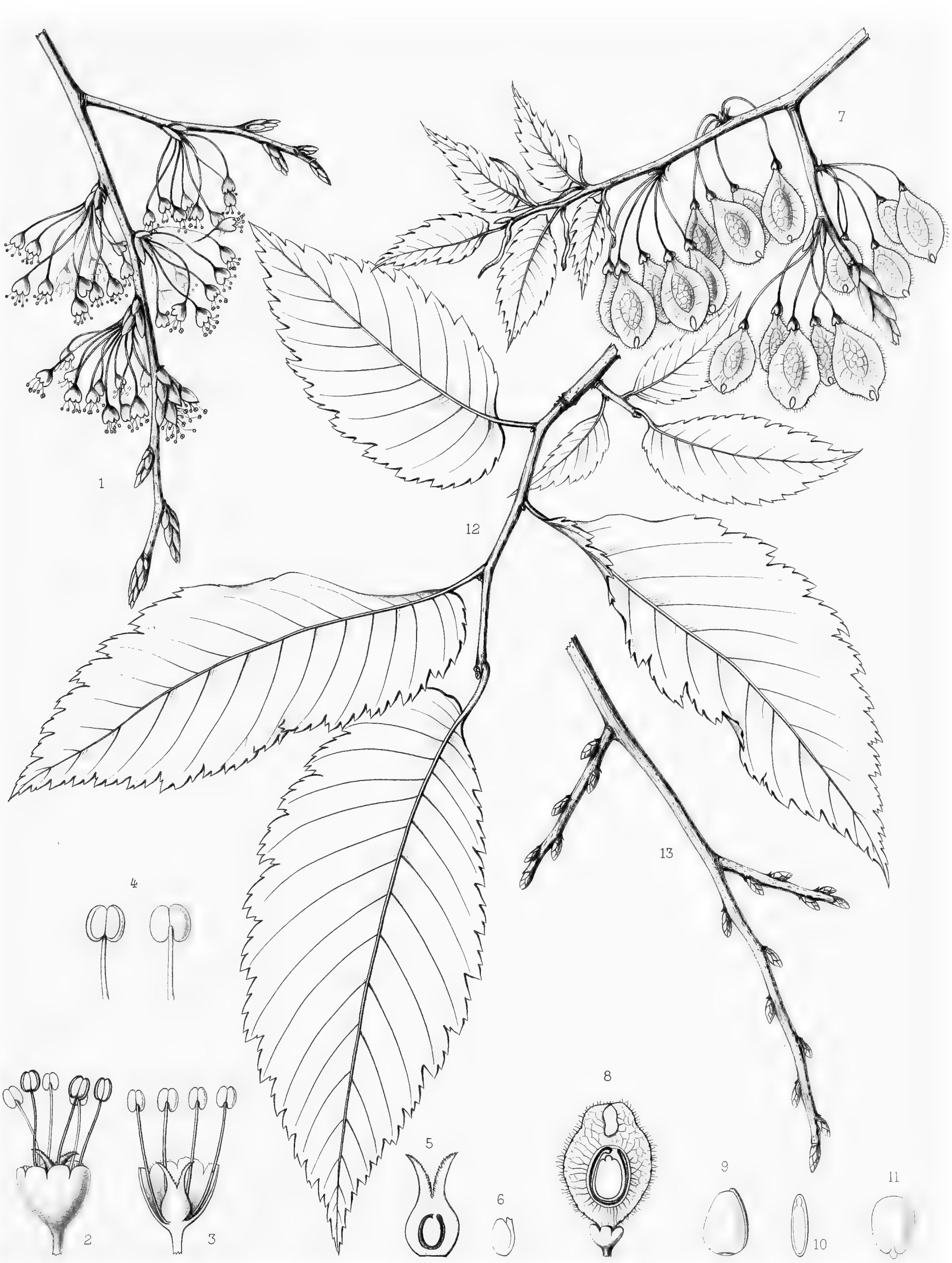
[5] Aiton, *Hort. Kew.* i. 320. — Loudon, *Arb. Brit.* iii. 1406, f. 1246.

[6] *Garden and Forest*, vi. 377.

EXPLANATION OF THE PLATE.

PLATE CCCXI. ULMUS AMERICANA.

1. A flowering branch, natural size.
2. A flower, enlarged.
3. Vertical section of a flower, enlarged.
4. A stamen, front and rear views, enlarged.
5. Vertical section of a pistil, enlarged.
6. An ovule, much magnified.
7. A fruiting branch, natural size.
8. Vertical section of a fruit, enlarged.
9. A seed, enlarged.
10. Vertical section of a seed, enlarged.
11. An embryo, enlarged.
12. A summer branch, natural size.
13. A winter branch, natural size.



C.E. Faxon del. *Lövendal sc.*

ULMUS AMERICANA, L

A. Riocreux direx^t *Imp. J. Taneur, Paris.*

ULMUS RACEMOSA.

Rock Elm. Cork Elm.

FLOWERS on long drooping pedicels. Fruit hirsute. Leaves obovate to oblong-oval, smooth on the upper, soft pubescent on the lower surface. Bud-scales puberulous. Branches often furnished with corky wings.

Ulmus racemosa, Thomas, *Am. Jour. Sci.* xix. 170, t. (1831). — Nuttall, *Sylva*, i. 37, t. 12. — Torrey, *Fl. N. Y.* ii. 166, t. 96. — Chapman, *Fl.* ed. 2, Suppl. 649. — Sargent, *Forest Trees N. Am.* 10*th Census U. S.* ix. 123. — Koehne, *Deutsche Dendr.* 136. — Watson & Coulter, *Gray's Man.* ed. 6, 462. — Dippel, *Handb. Laubholzk.* ii. 34.

Ulmus Americana, Planchon, *De Candolle Prodr.* xvii. 155 (in part) (not Linnæus) (1873).

A tree, eighty to one hundred feet in height, with a trunk occasionally three feet in diameter, which diminishes slowly in thickness and is often free of branches for sixty feet, short stout spreading limbs which form a narrow round-topped head, and slender rigid branchlets usually furnished with numerous broad irregular corky wings. The bark of the trunk is three quarters of an inch to an inch in thickness, and is gray tinged with red, and deeply divided by wide irregular interrupted fissures into broad flat ridges, which are broken on the surface into large irregularly shaped scales. The branches, when they first appear, are light brown, and coated with soft pale pubescence, which often does not entirely disappear until their second season; and in their first winter they are light reddish brown, puberulous, or glabrous and lustrous, and marked with scattered oblong lenticels and with large orbicular or semiorbicular leaf-scars in which is an irregular row of four to six fibro-vascular bundle-scars; later they become dark brown or ashy gray. The two or sometimes three or four thick corky irregular ridges, which are often half an inch broad, begin to appear during the first but more often during the second year. The leaf-buds are ovate, acute, a quarter of an inch long, and covered by about fourteen broadly ovate rounded chestnut-brown scales, pilose on the outer surface, and ciliate on the margins with soft white hairs; as the bud opens the scales gradually lengthen from without inward, and at maturity the two or three inner scales which replace the stipules of the first leaves are ovate-oblong to lanceolate, half an inch in length, often furnished at the base on each side with one or two minute teeth, bright green below the middle, marked with a red blotch above, and white and scarious at the apex. The leaves are obovate to oblong-oval, rather abruptly narrowed at the apex into short broad points, equally or somewhat unequally rounded, wedge-shaped or subcordate at the base, and coarsely and doubly serrate; when they unfold they are pilose on the upper surface, and covered on the lower with close soft white hairs; and at maturity they are two to two and a half inches long and three quarters of an inch to an inch wide, thick and firm, smooth, dark green and lustrous above, paler and coated with short soft pubescence below, especially on the stout midribs deeply impressed on the upper side, and on the numerous straight veins running to the points of the teeth and connected by obscure coarse veinlets, and on the petioles, which are about a quarter of an inch in length. The stipules of the upper leaves are ovate-lanceolate, conspicuously veined, light green, marked with dark red on the margins above the middle, and two thirds of an inch long; they clasp the stem by their abruptly enlarged united cordate bases furnished on each side with two or three prominent teeth, and disappear when the leaves are half grown. In the autumn the leaves turn to a bright clear yellow color before falling. The inflorescence-buds, which sometimes produce also one or two small leaves, are slightly larger than the flower-buds. The flowers are in two to four, but usually in three-flowered puberulous cymes, which

become more or less racemose by the lengthening of the axis of the inflorescence, which, when fully grown, is sometimes two inches in length; they are produced on elongated slender drooping pedicels often half an inch in length, those of the lateral flowers being developed from the axils of narrow obovate pointed bracts scarious and brown above the middle, a third of an inch long, terminated by tufts of long white hairs, and furnished at the base with two bractlets smaller than the bract, but otherwise resembling it. The calyx is green, and is divided nearly to the middle into seven or eight rounded dark red scarious lobes, which soon turn brown and wither. The stamens, with slender light green filaments and dark purple anthers, are exserted. The ovary is coated with long pale hairs, particularly on the thin margins, and is crowned by the light green styles. The fruit, which ripens in May, when the leaves are about half grown, is ovate or obovate-oblong, and half an inch in length, with a shallow open notch at the apex; it is obscurely veined, covered with short pale pubescence, and ciliate on the slightly thickened border of the broad wing; the margin of the seminal cavity is scarcely thickened, and the line of union of the two carpels is obsolete.

Ulmus racemosa is distributed from the eastern townships of the Province of Quebec,[1] where it is rare, westward through Ontario, and southward through northwestern New Hampshire, where it is rare and local, to southern Vermont; it ranges westward in the United States through northern New York and southern Michigan to northeastern Nebraska,[2] southeastern Missouri, and middle Tennessee.

The Rock Elm grows on dry gravelly uplands, where its most frequent companion is the Sugar Maple, on low heavy clay soil, rocky slopes, and river cliffs. Comparatively rare in the east and toward the extreme western and southern limits of its range, it is most abundant and attains its largest size in Ontario and the southern peninsula of Michigan.

The wood of *Ulmus racemosa* is heavy, hard, very strong and tough, close-grained, and susceptible of receiving a beautiful polish; it contains numerous obscure medullary rays and bands of one or two rows of small open ducts marking the layers of annual growth. It is light clear brown, often tinged with red, with thick lighter colored sapwood. The specific gravity of the absolutely dry wood is 0.7263, a cubic foot weighing 45.26 pounds. It is largely employed in the manufacture of heavy agricultural implements, like plows and mowing and threshing machines, for the framework of chairs, for the hubs of wheels and the beams of stump pullers, for railway ties, bridge timbers, the sills of large buildings, and other purposes where strength, toughness, solidity, and flexibility are required.[3]

Ulmus racemosa was first distinguished by David Thomas[4] in Cayuga County, New York, who published the earliest account of it in 1831.

The value of the wood of the Rock Elm threatens its extinction; and most of the large trees have already been cut in the forests of Canada, New England, New York, and Michigan. The Rock Elm[5] is sometimes planted as a shade-tree in the region which it inhabits naturally, and although it grows rather more slowly than the White Elm, it is a handsome and distinct ornamental tree, which planters have too generally neglected.

[1] Brunet, *Cat. Vég. Lig. Can.* 45. — Bell, *Geolog. Rep. Can.* 1879–80, 55°. — Macoun, *Cat. Can. Pl.* 428.

[2] In Nebraska *Ulmus racemosa* is now known to occur only near Meadville, in Keya Paha County (Bessey, *Rep. Nebraska State Board Agric.* 1894, 105).

[3] Sargent, *Rep. Sec. Board Agric. Mass.* xxv. 271.

[4] David Thomas (1776–1859) was a native of Montgomery County, Pennsylvania, of Quaker parentage, and by profession a civil engineer. In 1805 he settled near Aurora in Cayuga County, New York, subsequently becoming the chief engineer of the western portion of the Erie Canal, and later one of the principal engineers of the Welland Canal. He was much interested in horticulture and pomology, and by his writings on these subjects, which were principally published in the *Genesee Farmer*, rendered conspicuous services to agricultural science. In 1819, Mr. Thomas published at Auburn, New York, *Travels through the Western Country in the Year* 1816. In addition to his account of *Ulmus racemosa* he contributed to the *American Journal of Science and Arts*, *Some Account of the Chrysomela vitivora* (xxvi. 113, t.); *Remarks on the Specific Character of Corydalis formosa and Corydalis Canadensis* (xxvi. 114); and *Description of a New Species of Liatris* (xxxvii. 338, f.).

[5] *Ulmus racemosa* is sometimes known as Hickory Elm, White Elm, and Cliff Elm.

EXPLANATION OF THE PLATE.

Plate CCCXII. Ulmus racemosa.

1. A flowering branch, natural size.
2. A cluster of flowers subtended by a bud-scale, and showing the bracts and bractlets of the lateral flowers, enlarged.
3. A flower, enlarged.
4. Vertical section of a flower, enlarged.
5. A fruiting branch, natural size.
6. Vertical section of a fruit, enlarged.
7. An embryo, slightly enlarged.
8. A young leaf with stipules, natural size.
9. A summer branch, natural size.
10. A winter branch, natural size.

C E. Faxon del. *Lövendal sc.*

ULMUS RACEMOSA, Thomas.

A. Riocreux direx.t *Imp. J. Taneur, Paris.*

ULMUS ALATA.

Wahoo. Winged Elm.

FLOWERS on drooping pedicels. Fruit hirsute. Leaves ovate-oblong to oblong-lanceolate, smooth on the upper, pubescent on the lower surface. Bud-scales nearly glabrous. Branchlets usually furnished with broad corky wings.

Ulmus alata, Michaux, *Fl. Bor.-Am.* i. 173 (1803). — Persoon, *Syn.* i. 291. — Michaux f. *Hist. Arb. Am.* iii. 275, t. 5. — Pursh, *Fl. Am. Sept.* i. 200. — Nuttall, *Gen.* i. 201. — Roemer & Schultes, *Syst.* vi. 299. — Elliott, *Sk.* i. 334. — Sprengel, *Syst.* i. 931. — Audubon, *Birds*, t. 18. — Dietrich, *Syn.* ii. 992. — Planchon, *Ann. Sci. Nat.* sér. 3, x. 270; *De Candolle Prodr.* xvii. 155. — Walpers, *Ann.* iii. 425. — Curtis, *Rep. Geolog. Surv. N. Car.* 1860, iii. 55. — Chapman, *Fl.* 417. — Ridgway, *Proc. U. S. Nat. Mus.* 1882, 70. — Sargent, *Forest Trees N. Am. 10th Census U. S.* ix. 124. — Watson & Coulter, *Gray's Man.* ed. 6, 462. — Coulter, *Contrib. U. S. Nat. Herb.* ii. 406 (*Man. Pl. W. Texas*).

Ulmus pumila, Walter, *Fl. Car.* 111 (not Linnæus) (1788).

? Ulmus longifolia, Rafinesque, *New Fl.* iii. 38 (1836).

? Ulmus dimidiata, Rafinesque, *New Fl.* iii. 39 (1836).

Ulmus Americana, γ alata, Spach, *Ann. Sci. Nat.* sér. 2, xv. 364 (1841); *Hist. Vég.* xi. 109.

A tree, forty to fifty feet in height, with a trunk rarely two feet in diameter, short stout spreading or erect branches which form a narrow oblong and rather open round-topped head, and slender branches naked or usually furnished with corky wings;[1] or commonly, especially in the territory east of the Mississippi River, much smaller. The bark of the trunk, which rarely exceeds a quarter of an inch in thickness, is light brown tinged with red, and is divided by irregular shallow fissures into flat ridges covered with small closely appressed scales. The branchlets are slender, and when they first appear are glabrous or puberulous and light green tinged with red, and in their first winter are light reddish brown or ashy gray, glabrous or on vigorous individuals frequently coated with short soft hairs, and marked with occasional small orange-colored lenticels and with small elevated horizontal semiorbicular leaf-scars; the corky wings of the branches, of which there are usually two, and which sometimes begin to grow during their first but more often during their second season, are thin, regular, abruptly arrested at the nodes, and half an inch in width, and do not disappear for many years. The buds are slender, acute, an eighth of an inch long, and covered with dark chestnut-brown glabrous or slightly puberulous scales; those of the inner series are at maturity oblong or obovate, rounded and tipped at the apex with minute points, thin, scarious, light red especially above the middle, and half an inch long. The leaves are ovate-oblong to oblong-lanceolate, often somewhat falcate, acute or acuminate at the apex, unequally wedge-shaped or rounded or subcordate at the base, and coarsely and doubly serrate with incurved teeth; when they unfold they are pale green, often tinged with red, coated on the lower surface with soft white pubescence, and glabrous or nearly so on the upper surface, and at maturity are thick and firm or subcoriaceous, dark green and smooth above, and pale and coated below with soft pubescence which is thickest on the stout yellow midribs and on the numerous straight prominent veins arcuate and often forked near the margins and connected by rather conspicuous reticulate cross veinlets; they are two to two and a half inches in length and one half to three quarters of an inch in width, and are borne on stout pubescent petioles a third of an inch long. The stipules are linear-obovate, acute, thin and scarious, tinged with red above the middle and often nearly an inch long. In the autumn the leaves turn to a dull yellow color before falling. The flowers are produced in short few-flowered fascicles and appear in February or March on drooping pedicels furnished with linear acute scarious bracts and bractlets. The calyx is glabrous and divided nearly to the middle into broad

[1] Rothrock, *Garden and Forest*, ii. 599.

ovate rounded lobes, and is as long as the ovary, which is raised on a short slender stipe and is coated with dense white tomentum. The fruit, which ripens just before or with the unfolding of the leaves, is oblong, a third of an inch long, contracted at the base into a long slender stalk, gradually narrowed and tipped at the apex with large incurved horns, and coated with long white hairs which are most numerous on the thickened margin of the narrow wing. The seed is ovate, pointed, an eighth of an inch long, and covered with a pale chestnut-brown coat slightly thickened into a narrow wing-like margin.

Ulmus alata usually grows on dry gravelly uplands, and sometimes in rich alluvial soil on the borders of swamps and near the banks of streams, and is distributed from southern Virginia through the middle districts to western Florida, and from southern Indiana and Illinois through western Kentucky and Tennessee to the shores of the Gulf of Mexico and through southern Missouri,[1] Arkansas, and the eastern portions of the Indian Territory to the valley of the Trinity River in Texas, growing to its largest size and most abundantly in the region west of the Mississippi River.

The wood of *Ulmus alata* is heavy, hard, although not strong, close-grained and difficult to split; it contains inconspicuous remote medullary rays, and is light brown, with thick lighter colored sapwood. The specific gravity of the absolutely dry wood is 0.7491, a cubic foot weighing 46.68 pounds. It is sometimes employed for the hubs of small wheels and the handles of tools. From the inner bark rope used for fastening the covers on cotton-bales has been made.[2]

Ulmus alata[3] was first described in the *Flora Caroliniana* of Walter, published in 1788. The good habit, rapid growth, small size, and abundant foliage of the Wahoo make it a desirable ornamental tree, and it is often planted in the southern states to shade the streets of towns and villages. According to Loudon,[4] it was introduced into English gardens in 1820.

[1] Broadhead, *Bot. Gazette*, iii. 60.

[2] Porcher, *Resources of Southern Fields and Forests*, 311.

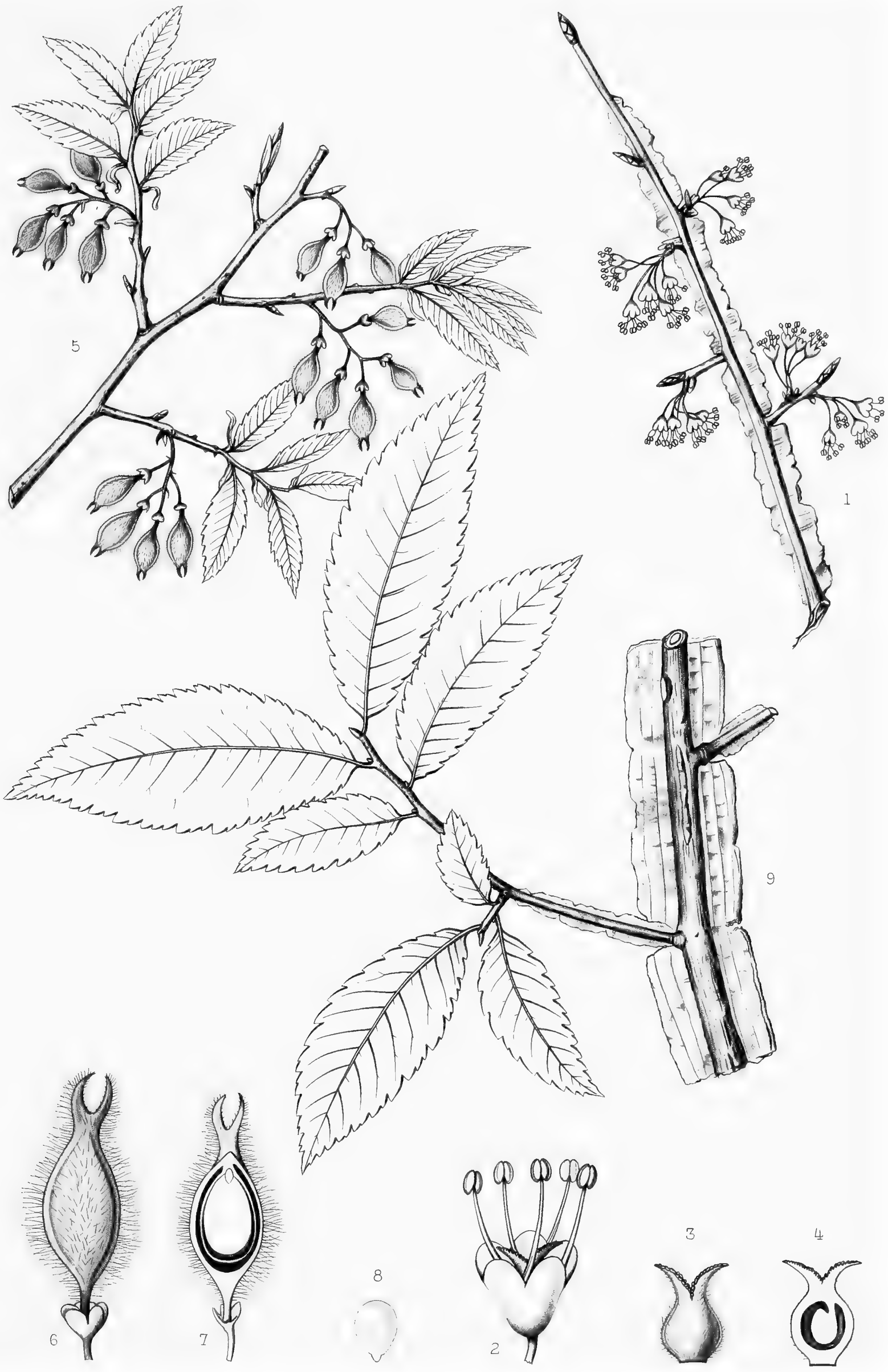
[3] In Arkansas *Ulmus alata* is sometimes called Red Elm and Mountain Elm (F. L. Harvey, *Am. Jour. Forestry*, i. 451).

[4] Loudon, *Arb. Brit.* iii. 1408, f. 1248.

EXPLANATION OF THE PLATE.

PLATE CCCXIII. ULMUS ALATA.

1. A flowering branch, natural size.
2. A flower, enlarged.
3. A pistil, enlarged.
4. Vertical section of a pistil, enlarged.
5. A fruiting branch, natural size.
6. A fruit, enlarged.
7. Vertical section of a fruit, enlarged.
8. An embryo, enlarged.
9. A summer branch, natural size.



C.E. Faxon del. Lovendal sc.

ULMUS ALATA, Michx.

A. Riocreux direx.t Imp. J. Taneur, Paris.

ULMUS FULVA.

Slippery Elm. Red Elm.

FLOWERS on short pedicels in crowded fascicles. Fruit naked on the margins, pubescent. Leaves ovate-oblong, scabrous on the upper, pubescent on the lower surface. Bud-scales coated with rusty brown hairs. Branchlets destitute of corky wings.

Ulmus fulva, Michaux, *Fl. Bor.-Am.* i. 172 (1803). — Persoon, *Syn.* i. 291. — Willdenow, *Enum.* Suppl. 14. — Pursh, *Fl. Am. Sept.* i. 200. — Nuttall, *Gen.* i. 201. — Roemer & Schultes, *Syst.* vi. 301. — Elliott, *Sk.* i. 333. — Hayne, *Dendr. Fl.* 32. — Sprengel, *Syst.* i. 931. — Hooker, *Fl. Bor.-Am.* ii. 142. — Bigelow, *Fl. Boston.* ed. 3, 115. — Dietrich, *Syn.* ii. 992. — Spach, *Ann. Sci. Nat.* sér. 2, xv. 363; *Hist. Vég.* xi. 107. — Torrey, *Fl. N. Y.* ii. 166. — Planchon, *Ann. Sci. Nat.* sér. 3, x. 276; *De Candolle Prodr.* xvii. 161. — Walpers, *Ann.* iii. 426. — Darlington, *Fl. Cestr.* ed. 3, 255. — Curtis, *Rep. Geolog. Surv. N. Car.* 1860, iii. 55. — Chapman, *Fl.* 416. — Koch, *Dendr.* ii. 422. — Emerson, *Trees Mass.* ed. 2, ii. 334, t. — Lauche, *Deutsche Dendr.* 348. — Ridgway, *Proc. U. S. Nat. Mus.* 1882, 72. — Sargent, *Forest Trees N. Am.* 10*th Census U. S.* ix. 122. — Koehne, *Deutsche Dendr.* 136, f. 27, G. — Watson & Coulter, *Gray's Man.* ed. 6, 462. — Dippel, *Handb. Laubholzk.* ii. 30, f. 8.

? **Ulmus pubescens**? Walter, *Fl. Car.* 112 (1788). — Sudworth, *Rep. Sec. Agric.* 1892, 327.

Ulmus Americana, *a* **rubra**, Aiton, *Hort. Kew.* i. 319 (1789). — Willdenow, *Spec.* i. pt. ii. 1325. — Stokes, *Bot. Mat. Med.* ii. 35. — Hayne, *Dendr. Fl.* 31.

? **Ulmus crispa**, Willdenow, *Enum.* 295 (1809); *Berl. Baumz.* ed. 2, 520.

Ulmus rubra, Michaux f. *Hist. Arb. Am.* iii. 278, t. 6 (1813).

? **Ulmus pinguis**, Rafinesque, *Fl. Ludovic.* 115 (1817).

A tree, sixty to seventy feet in height, with a trunk occasionally two feet in diameter, and spreading branches which usually form a broad open flat-topped head. The bark of the trunk is frequently an inch in thickness and is dark brown tinged with red, divided by shallow fissures and covered with large thick appressed scales. The branchlets are stout, and, when they first appear, are bright green, scabrate, and coated with soft pale pubescence which does not entirely disappear until their first winter; they become light brown by midsummer, and are often roughened with small pale lenticels; during their first winter they are ashy gray, orange-color, or light red-brown, and marked with large elevated semiorbicular leaf-scars in which appear the ends of three conspicuous equidistant fibro-vascular bundles; ultimately they become dark gray or brown. The leaf-buds are ovate, rather obtuse, a quarter of an inch long, and covered with about twelve closely imbricated scales; the outer scales are broadly ovate, rounded, dark chestnut-brown, and covered with long scattered rusty hairs; those next within them are coated on the outer surface above the middle with thick rusty brown tomentum, and the scales of the inner rows, which replace the stipules of the lower leaves, are when fully grown half an inch long, an eighth of an inch to a quarter of an inch wide, light green, strap-shaped, rounded and tipped at the apex with tufts of rusty hairs, puberulous on the outer surface and slightly ciliate on the margins, gradually growing narrower and passing into the stipules of the upper leaves. The leaves are ovate-oblong, abruptly contracted into long slender points, rounded at the base on one side and shorter and oblique on the other, and coarsely and doubly serrate with incurved callous-tipped teeth; when they unfold they are thin, coated on the lower surface with pale pubescence, and pilose on the upper surface with scattered white hairs, and at maturity they are thick and firm, dark green and rugose on the upper surface with crowded sharp-pointed tubercles pointed toward the apex of the leaf, paler, soft and smooth on the lower surface, and coated with white hairs which are most abundant on the slender yellow midribs deeply impressed above, and in the axils of the slender straight veins which are often forked near the margins; they are five to seven inches long, two to three

inches wide, and are borne on stout pubescent petioles a third of an inch in length. The stipules of the upper leaves are obovate-oblong to oblong-lanceolate, thin and scarious, coated with pale pubescence and tipped with clusters of rusty brown hairs. The leaves turn to a dull yellow color before falling in the autumn. The inflorescence-buds are larger and more obtuse than the leaf-buds, which they resemble in the shape of the scales and their covering; from each of the six or eight inner scales the two to three-flowered short pedunculate clusters of flowers are produced. The flowers, which appear at the south in February and March and at the north from the middle to the end of April, are borne on short pedicels produced from the axils of minute linear green bracts with a few short white hairs at the apex. The calyx is green, coated with pale hairs, and slightly divided into five to nine short rounded thin and scarious equal lobes. The stamens are exserted, with slender light yellow slightly flattened filaments and dark red anthers which do not shed their pollen until after the slightly exserted reddish purple stigmas papillose with soft white hairs have begun to wither. The fruit, which ripens when the leaves are about half grown, is semiorbicular, rounded, slightly emarginate or with the remains of one or of both stigmas at the apex, rounded or wedge-shaped at the base, and half an inch broad; the seminal cavity is coated with thick rusty brown tomentum, and the broad thin wing is obscurely reticulate-veined, naked on the thickened margin, and marked by the dark conspicuous horizontal line of union of the two carpels. The seed is ovate, with a large oblique pale hilum, and is covered with a light chestnut-brown coat produced into a thin wing which is wider below than above the middle of the seed.

Ulmus fulva is distributed from the island of Orleans in the lower St. Lawrence River through Ontario to North Dakota and eastern Nebraska,[1] and southward to western Florida, central Alabama and Mississippi, and the valley of the San Antonio River in Texas.

A comparatively common tree, although everywhere less common than the White Elm, it inhabits the banks of streams and low rocky hillsides, where it grows in deep fertile soil.

The wood of *Ulmus fulva* is heavy, hard, strong, very close-grained, durable in contact with the soil, and easy to split while green; it contains numerous thin medullary rays and broad bands of several rows of large open ducts marking the layers of annual growth, and is dark brown or red, with thin lighter colored sapwood. The specific gravity of the absolutely dry wood is 0.6956, a cubic foot weighing 43.35 pounds. It is largely used for fence-posts and railway ties, for the sills of buildings, the hubs of wheels, and agricultural implements.

The thick fragrant inner bark of the branches is mucilaginous, demulcent, and slightly nutritious; it is employed in the treatment of acute inflammatory and febrile affections, and is used in the form of a powder externally in poultices.[2]

The Slippery Elm appears to have been first distinguished by Clayton,[3] and what is probably the earliest description of it appeared in his *Flora Virginica*,[4] published in 1739. In cultivation it is a handsome shapely fast-growing tree; but in public parks and streets its use is to be avoided, for once its identity is established it usually falls a prey to boys eager to devour the inner bark of the branches.

[1] Bessey, *Rep. Nebraska State Board Agric.* 1894, 105.

[2] Rafinesque, *Med. Bot.* ii. 271. — Griffith, *Med. Bot.* 563. — Porcher, *Resources of Southern Fields and Forests*, 310. — Flückiger & Hanbury, *Pharmacographia*, 501. — Johnson, *Man. Med. Bot. N. A.* 243. — *U. S. Dispens.* ed. 16, 1549.

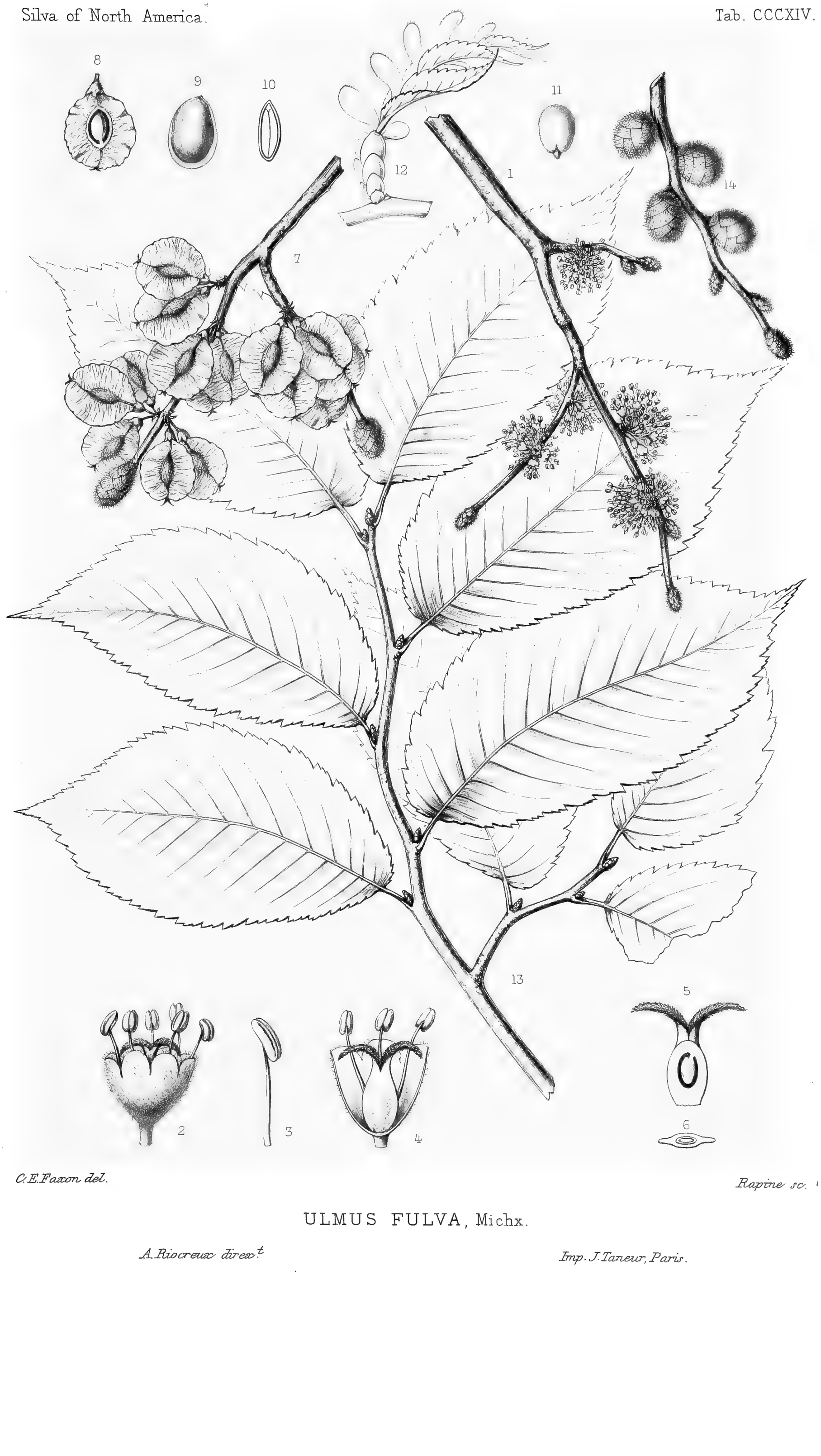
[3] See i. 8.

[4] *Ulmus fructu membranaceo, foliis simplicissime serratis*, 145.

EXPLANATION OF THE PLATE.

Plate CCCXIV. Ulmus fulva.

1. A flowering branch, natural size.
2. A flower, enlarged.
3. A stamen, enlarged.
4. Vertical section of a flower, enlarged.
5. Vertical section of a pistil, enlarged.
6. Cross section of an ovary, enlarged.
7. A fruiting branch, natural size.
8. Vertical section of a fruit, natural size.
9. A seed, enlarged.
10. Vertical section of a seed, enlarged.
11. An embryo, enlarged.
12. A young branch with unfolding leaves showing the accrescent bud-scales and stipules, natural size.
13. A summer branch, natural size.
14. A winter branch, the flower-buds beginning to enlarge, natural size.



C.E.Faxon del. Rapine sc.

ULMUS FULVA, Michx.

A. Riocreux direx.t Imp. J. Taneur, Paris.

ULMUS CRASSIFOLIA.

Cedar Elm.

FLOWERS autumnal, short-pedicellate. Fruit hirsute. Leaves ovate, scabrous on the upper, soft-pubescent on the lower surface. Bud-scales puberulous. Branchlets usually furnished with corky wings.

Ulmus crassifolia, Nuttall, *Trans. Am. Phil. Soc.* n. ser. v. 169 (1837). — Planchon, *Ann. Sci. Nat.* sér. 3, x. 279; *De Candolle Prodr.* xvii. 162. — Walpers, *Ann.* iii. 426. — Sargent, *Forest Trees N. Am. 10th Census U. S.* ix. 122. — Koehne, *Deutsche Dendr.* 135, f. 27 B. — Dippel, *Handb. Laubholzk.* ii. 35. — Coulter, *Contrib. U. S. Nat. Herb.* ii. 406 (*Man. Pl. W. Texas*).

Ulmus opaca, Nuttall, *Sylva*, i. 35, t. 11 (1842).

A tree, often eighty feet in height, with a tall straight trunk two to three feet in diameter, sometimes free of branches for thirty or forty feet, and dividing into numerous stout spreading limbs which form a broad inversely conical round-topped head with long pendulous branches, or while young, or when growing on dry uplands, a compact round head of drooping branches. The bark of the trunk, which is sometimes nearly an inch in thickness, is light brown slightly tinged with red, and deeply divided by interrupted fissures into broad flat ridges, broken on the surface into thick scales. The branchlets are slender and often furnished with corky wings, and, when they first appear, are tinged with red, and coated with soft pale pubescence; during their first winter they are light reddish brown, puberulous, and marked with scattered minute pale lenticels, and with small elevated semiorbicular leaf-scars, in which appear the ends of three small fibro-vascular bundles; the two corky wings with which they are frequently furnished are covered with lustrous red-brown bark, and when fully grown are a quarter to a half of an inch broad; they are sometimes continuous, except when abruptly interrupted by lateral branchlets, or are often irregularly developed. The leaf-buds are broadly ovate, acute, an eighth of an inch long, and covered with closely imbricated chestnut-brown scales, slightly puberulous on the outer surface; those of the inner ranks are at maturity oblong, concave, rounded at the apex, thin, bright red, and sometimes three quarters of an inch in length. The leaves are oblong-oval, acute or rounded at the apex, unequally rounded or wedge-shaped and often oblique at the base, and coarsely and unequally doubly serrate with callous-tipped teeth; when they unfold, which is in February and March, they are thin, light green, tinged with red, pilose above, and covered below with soft pale pubescence, and at maturity are thick and subcoriaceous, dark green and lustrous on the upper surface, which is roughened with crowded minute sharp-pointed tubercles, pale yellow-green and coated with soft pubescence on the lower surface, one to two inches long, and one half of an inch to an inch wide, with stout yellow midribs slightly impressed above, prominent straight veins, often forked near the margin, obscure on the upper side, and connected by conspicuous more or less reticulate cross veinlets. The stipules, which are half an inch long, linear-lanceolate, and red and scabrous above, clasp the stem by their abruptly enlarged cordate green and hairy bases, and fall when the leaves are about half grown. The leaves turn bright yellow, and fall late in October or early in November, or turn brown and wither on the branches in years of exceptional dryness. The inflorescence-buds appear early in the season in the axils of leaves of the year; the flowers, which usually open in August,[1] are produced in three to five-flowered pedunculate fascicles, and are borne on slender pedicels a third to a half of an inch in length, covered with long white hairs, and furnished with linear-lanceolate acute scarious bracts and bractlets. The calyx is divided to below the middle into oblong narrow pointed lobes, and is hairy at

[1] In favorable seasons a second crop of flowers sometimes appears in October from which seeds often ripen a month later.

the base. The ovary is coated with pale hairs, and crowned with two short slightly exserted stigmas. The fruit ripens in September, and is oblong, gradually and often irregularly narrowed from the middle to the two ends, short-stalked, deeply notched at the apex, one third to nearly one half of an inch long, and covered with soft white hairs, which are most developed on the slightly thickened margin of the broad obscurely veined wing. The seed is ovate-oblique, pointed, and covered with a dark chestnut-brown coat.[1]

Ulmus crassifolia is distributed from the valley of the Sunflower River in Mississippi through southern Arkansas and Texas to Nuevo Leon,[2] ranging in western Texas from the coast to the valley of the Pecos River.[3] In Arkansas the Cedar Elm grows usually on river cliffs and low hillsides,[4] and in Texas, where it is the common Elm-tree, and where it attains its largest size on the rich bottom-lands of the Guadaloupe and Trinity Rivers, it grows near streams in deep alluvial soil and on the dry limestone hills which rise from them, usually with Live Oaks and Nettle-trees.

The wood of *Ulmus crassifolia* is heavy, hard, not strong, brittle, close-grained, with obscure medullary rays and bands of ducts marking the layers of annual growth; it is light brown tinged with red, with thick lighter colored sapwood. The specific gravity of the absolutely dry wood is 0.7245, a cubic foot weighing 45.15 pounds. In central Texas it is used in considerable quantities in the manufacture of the hubs of wagon-wheels and saddle-trees, for furniture, and largely in fencing; grown in the dry climate of the Rio Grande basin, the Cedar Elm is less valuable as a timber-tree, and produces lumber of an inferior quality, and poor fuel.

Ulmus crassifolia was discovered by Thomas Nuttall[5] in 1819 near the Red River in south-western Arkansas. As it grows on the bottom-lands of the rivers of central Texas, the Cedar Elm, with its broad head of long pendulous branches covered with dark green lustrous leaves, is one of the most beautiful and graceful trees of North America.[6] It is occasionally[7] planted as a shade-tree in the streets of cities and towns in Texas; but, except in Texas, is rarely seen in cultivation.

[1] The seeds of *Ulmus crassifolia* do not apparently germinate in Texas until after the rains of the early spring.

[2] C. G. Pringle, *Garden and Forest*, iii. 362.

[3] Havard, *Proc. U. S. Nat. Mus.* 1882, 506.

[4] F. L. Harvey, *Am. Jour. Forestry*, i. 451.

[5] See ii. 34.

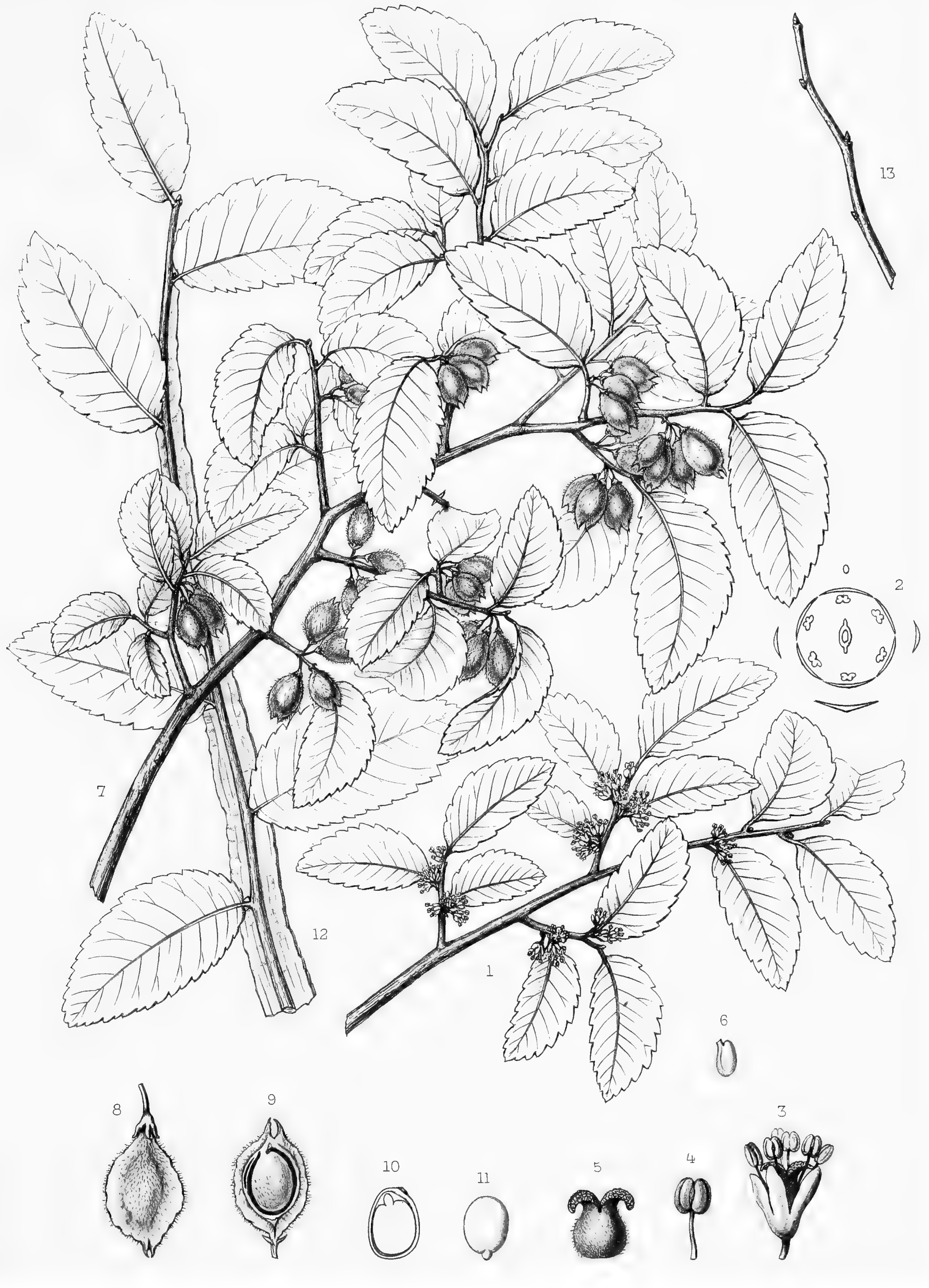
[6] In Texas the beauty of *Ulmus crassifolia* is often injured by the Spanish Moss (*Tillandsia usneoides*, Linnæus), which frequently drapes the branches, and ultimately weakens, and finally destroys the tree.

[7] Reverchon, *Garden and Forest*, vi. 524.

EXPLANATION OF THE PLATE.

PLATE CCCXV. ULMUS CRASSIFOLIA.

1. A flowering branch, natural size.
2. Diagram of a flower.
3. A flower, enlarged.
4. A stamen, enlarged.
5. A pistil, enlarged.
6. An ovule, much magnified.
7. A fruiting branch, natural size.
8. A fruit, enlarged.
9. Vertical section of a fruit, enlarged.
10. Vertical section of a seed, enlarged.
11. An embryo, enlarged.
12. A summer branch, natural size.
13. A winter branch, natural size.



C.E. Faxon del. *Rapine sc.*

ULMUS CRASSIFOLIA, Nutt.

A. Riocreux direx.t *Imp. J. Taneur, Paris.*

PLANERA.

FLOWERS polygamo-monœcious; calyx 4 or 5-lobed, the lobes imbricated in æstivation; corolla 0; stamens 4 or 5; filaments erect before anthesis; disk 0; ovary superior, stipitate, 1-celled; ovule solitary, suspended. Fruit drupaceous, muricate. Leaves alternate, serrate, stipulate, deciduous.

Planera, Gmelin, *Syst. Nat.* ii. 150 (1791). — Endlicher, *Gen.* 276. — Meisner, *Gen.* 351. — Baillon, *Hist. Pl.* vi. 185. — Bentham & Hooker, *Gen.* iii. 352. — Engler & Prantl, *Pflanzenfam.* iii. pt. i. 63.

A tree, with watery juice, scaly bark, slender terete unarmed slightly zigzag puberulous branchlets marked with scattered pale lenticels, and at the end of their first season with small nearly orbicular leaf-scars in which appear a row of fibro-vascular bundle-scars, and fibrous roots. Buds axillary,[1] subglobose, minute, covered with numerous thin closely imbricated chestnut-brown scales, the outer more or less scarious on the margins; the inner accrescent with the young shoot, at maturity ovate-oblong, scarious, bright red, one third to nearly one half of an inch long, marking in falling the base of the branchlet with numerous ring-like pale conspicuous scars. Leaves alternate, distichous, conduplicate in vernation, ovate-oblong, acute or rounded at the narrowed apex, unequally wedge-shaped or rounded at the base, coarsely crenulate-serrate with unequal gland-tipped teeth, petiolate with slender terete puberulous petioles, penniveined, the numerous straight conspicuous veins forked near the margin, connected by coarse reticulate veinlets more conspicuous below than above; at first puberulous on the lower and pilose on the upper surface, at maturity thick and subcoriaceous, scabrate, deciduous; stipules lateral, free, ovate, acute, scarious, bright red, caducous. Flowers articulate, minute, appearing with the leaves in early spring, the staminate fascicled in the axils of the outer scales of leaf-bearing buds, short-pedicellate, the pistillate or perfect on elongated puberulous pedicels in the axils of leaves of the year in one to three-flowered fascicles. Pedicels ebracteolate. Calyx campanulate, divided nearly to the base into four or five lobes, rounded at the apex, greenish yellow, often tinged with red, sub-scarious, sub-marcescent. Stamens hypogynous, as many as the lobes of the calyx and opposite them; in the pistillate flower sometimes fewer or wanting; filaments filiform, erect, exserted; anthers broadly ovate, emarginate, cordate, attached on the back below the middle, introrse, two-celled, the cells opening longitudinally. Ovary ovate, stipitate, glandular-tuberculate, one-celled, narrowed into a short style divided into two elongated spreading reflexed stigmas, papillo-stigmatic on the inner face; wanting in the staminate flower; ovule solitary, suspended near the apex of the cell, anatropous; micropyle extrorse, superior. Fruit oblong, oblique, and narrowed below into a short stipe inclosed at the base by the withered calyx, crowned with the remnants of the style; pericarp crustaceous, fragile, prominently ribbed on the anterior and posterior faces, irregularly crested with thin plates, light chestnut-brown, puberulous, of two coats, the inner thin and papery, light chestnut-brown, and lustrous on the inner surface. Seed ovoid-oblique, pointed at the apex, rounded below, exalbuminous; testa thin, crustaceous, lustrous, dark brown or nearly black, of two coats; raphe inconspicuous. Embryo erect; cotyledons thick, unequal, bright orange-color, the apex of the larger cucullate and slightly infolding the smaller, much longer than the minute radicle turned toward the linear pale hilum.

The wood of Planera is light, soft, not strong, close-grained, and contains numerous thin medullary rays and occasional scattered open ducts. It is light brown, with thick nearly white sapwood

[1] Like Ulmus, Planera does not form a terminal bud, the end of the branch appearing during the winter as a small pale scar close to the upper axillary bud, by which it is prolonged during the following spring.

composed of twenty or thirty layers of annual growth. The specific gravity of the absolutely dry wood is 0.5294, a cubic foot weighing 32.99 pounds.

The genus is not known to possess useful properties.

The generic name preserves the memory of Johann Jakob Planer,[1] a German botanist and physician of the last century.

The genus is now represented by a single species.[2]

[1] Johann Jakob Planer (1743–1789), a native of Erfurt, pursued his scientific studies at Berlin and Leipzig, and in 1779 was appointed Professor of Medicine in the University of his native city, in which he afterward filled the Chairs of Botany and Chemistry. Planer was the author of several works on Botany and Rural Economy, including a catalogue of the plants growing in the neighborhood of Erfurt and papers on silviculture.

[2] Planera, or some genus closely related to it, inhabited Europe during the tertiary epoch (Zittel, *Handb. Palæontolog.* ii. 472); and in North America traces of several species of Planera found in the Upper and Middle Miocene rocks show that it once existed in the central Rocky Mountain region of the continent and in Alaska (Lesquereux, *U. S. Geolog. Surv.* vii. 189, t. 27, f. 4–6; viii. 161, t. 29, f. 1–13, t. 44, f. 10 [*Foss. Fl. Western Territories*, ii., iii.]).

PLANERA AQUATICA.

Water Elm.

Planera aquatica, Gmelin, *Syst. Nat.* ii. 150 (1791). — Willdenow, *Spec.* iv. pt. ii. 967 ; *Berl. Baumz.* ed. 2, 281 ; *Enum.* Suppl. 14. — Persoon, *Syn.* i. 291. — Du Mont de Courset, *Bot. Cult.* ed. 2, vi. 388. — Nuttall, *Gen.* i. 202. — Schmidt, *Oestr. Baumz.* iv. 14, t. 197. — Hayne, *Dendr. Fl.* 208. — Spach, *Ann. Sci. Nat.* sér. 2, xv. 355 ; *Hist. Vég.* xi. 116. — Planchon, *Ann. Sci. Nat.* sér. 3, x. 261 ; *De Candolle Prodr.* xvii. 167. — Walpers, *Ann.* iii. 428. — Chapman, *Fl.* 417. — Koch, *Dendr.* ii. 424. — Lauche, *Deutsche Dendr.* 350, f. 135. — Sargent, *Forest Trees N. Am.* 10*th Census U. S.* ix. 124. — Watson & Coulter, *Gray's Man.* ed. 6, 463. — Dippel, *Handb. Laubholzk.* ii. 36, f. 12. — Coulter, *Contrib. U. S. Nat. Herb.* ii. 407 (*Man. Pl. W. Texas*).

Anonymos aquatica, Walter, *Fl. Car.* 230 (1788).

Planera ulmifolia, Michaux f. *Hist. Arb. Am.* iii. 283, t. 7 (1813). — Poiret, *Lam. Dict.* Suppl. iv. 429. — *Nouveau Duhamel*, vii. 65. — Curtis, *Rep. Geolog. Surv. N. Car.* 1860, iii. 81.

Ulmus aquatica, Rafinesque, *Fl. Ludovic.* 165 (1817).

Planera Richardi, Torrey & Gray, *Pacific R. R. Rep.* ii. 175 (not Michaux) (1855).

A tree, thirty to forty feet in height, with a short trunk rarely exceeding twenty inches in diameter, and rather slender spreading branches which form a low broad head. The bark of the trunk is about a quarter of an inch thick and light brown or gray, separating into large scales which in falling disclose the red-brown inner bark. The branchlets, when they first appear, are brown tinged with red, and during their first winter are dark red and ultimately become reddish brown or ashy gray. The leaves unfold in February and March, and when fully grown are two to two and a half inches long and three quarters of an inch to an inch wide, and are borne on petioles varying from an eighth to a quarter of an inch in length ; they are dark dull green on the upper surface and paler on the lower surface, with yellow midribs and veins. The flowers appear with the leaves ; and the fruit, which is a third of an inch in length, ripens in April.

Planera aquatica inhabits deep swamps covered with water during several months of every year, and is distributed from the valley of the Cape Fear River in North Carolina to western Florida, and through southern Alabama and Mississippi to the valley of the Trinity River in Texas, ranging north through western Louisiana and Arkansas to southern Missouri and central Kentucky, and to the valley of the lower Wabash River in Illinois. Comparatively rare and confined to the neighborhood of the coast in the Atlantic and the eastern Gulf states, the Water Elm is very abundant in western Louisiana and southern Arkansas, where it attains its largest size.[1]

Planera aquatica was introduced into the gardens of Europe early in the present century,[2] and was occasionally cultivated in botanical collections, from which it has now, however, almost entirely disappeared.

Although it possesses much botanical interest, the Water Elm has little else to recommend it as an inhabitant of parks and gardens, and the high temperature of the region which it inhabits and the character of the soil and situation in which it grows make it a difficult tree to cultivate beyond the borders of its native swamps.

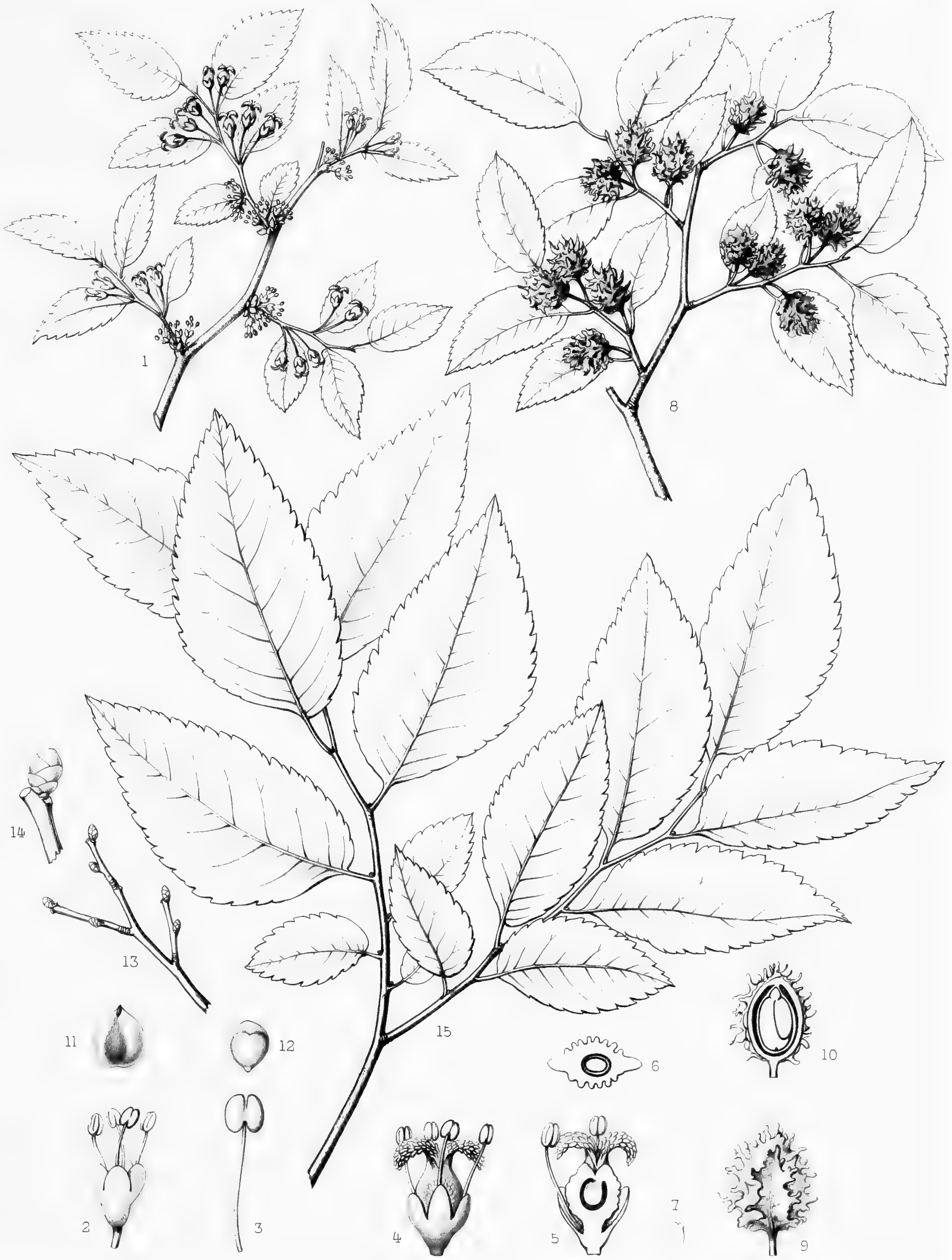
[1] F. L. Harvey, *Am. Jour. Forestry*, i. 451.

[2] Loudon, *Arb. Brit.* iii. 1413, f. 1251.

EXPLANATION OF THE PLATE.

PLATE CCCXVI. PLANERA AQUATICA.

1. A flowering branch, natural size.
2. A staminate flower, enlarged.
3. A stamen, rear view, enlarged.
4. A pistillate flower, enlarged.
5. Vertical section of a pistillate flower, enlarged.
6. Cross section of an ovary, enlarged.
7. An ovule, much magnified.
8. A fruiting branch, natural size.
9. A fruit, enlarged.
10. Vertical section of a fruit, enlarged.
11. A seed, enlarged.
12. An embryo, much magnified.
13. A winter branch, natural size.
14. A winter-bud, enlarged.
15. A summer branch, natural size.



C.E. Faxon del.

Migneaux sc.

PLANERA AQUATICA, Gmel.

A. Riocreux direx.t

Imp J. Taneur, Paris.

CELTIS.

FLOWERS polygamo-monœcious or rarely monœcious; calyx 4 to 5-parted, the divisions imbricated in æstivation; corolla 0; stamens 4 or 5; disk pulvinate; ovary 1-celled; ovule solitary, suspended. Fruit a fleshy drupe. Leaves alternate, deciduous or persistent, stipulate.

Celtis, Linnæus, *Gen.* 337 (1737). — Adanson, *Fam. Pl.* ii. 377. — A. L. de Jussieu, *Gen.* 408. — Endlicher, *Gen.* 276. — Meisner, *Gen.* 348. — Baillon, *Hist. Pl.* vi. 186. — Bentham & Hooker, *Gen.* iii. 354. — Engler & Prantl, *Pflanzenfam.* iii. pt. i. 63.

Mertensia, Humboldt, Bonpland & Kunth, *Nov. Gen. et Spec.* ii. 30 (not Roth nor Willdenow) (1817).

Momisia, F. G. Dietrich, *Lexic. Garten. u. Bot. Nachtr.* v. 128 (1819).

Solenostigma, Endlicher, *Prodr. Fl. Norf.* 41 (1833).

Trees or shrubs, with watery juice, thin, smooth, often more or less muricate bark, slender unarmed or spinose branches, scaly or naked buds, and fibrous roots. Leaves conduplicate in vernation, alternate, distichous, serrate or entire, often oblique at the base, penniveined, three or rarely four or five-nerved, petiolate, membranaceous or subcoriaceous, deciduous or persistent; stipules lateral, free, usually scarious, caducous. Flowers vernal, minute, pedicellate on branches of the year, the staminate cymose or fascicled at their base, the pistillate solitary or in few-flowered fascicles from the axils of upper leaves. Calyx slightly or deeply divided into four or rarely into five lobes, deciduous. Stamens as many as the lobes of the corolla, inserted under the margin of the usually hairy discoid torus; filaments subulate, sometimes incurved in æstivation and spreading elastically, erect and exserted after anthesis; in the pistillate flower usually shorter and included, or rarely wanting; anthers ovate, attached on the back just above the emarginate base, close together and face to face in the bud, two-celled, extrorse, the cells lateral, opening longitudinally. Ovary ovate, sessile, one-celled, crowned with a short sessile style divided into two divergent elongated reflexed lobes papillo-stigmatic on the inner face, entire or bifid, deciduous; in the pistillate flower minute and rudimentary; ovule solitary, suspended from the apex of the cell, anatropous. Fruit ovoid or globose; epicarp thick and firm; mesocarp thin and succulent; nutlet thick-walled, bony, smooth or rugose. Seed filling the seminal cavity; albumen scanty, gelatinous, nearly inclosed between the folds of the cotyledons, or wanting; testa membranaceous, of two confluent coats; chalaza colored, close to the minute hilum. Embryo curved; cotyledons broad, foliaceous, conduplicate or rarely flat, variously folded, corrugate, incumbent on or embracing the short superior ascending radicle.[1]

Celtis is widely distributed through the temperate and tropical regions of the world, fifty or sixty

[1] By Planchon (*De Candolle Prodr.* xvii. 168) Celtis is divided into the following subgenera: —

EUCELTIS. Staminate flowers articulate, in few-flowered fascicles from the axils of caducous bud-scales. Pistillate flowers solitary or in two or three-flowered fascicles from the axils of young leaves; stigmas linear, undivided. Leaves serrate or rarely entire, deciduous. Unarmed trees of the temperate regions of the northern hemisphere and of high mountains within the tropics.

SPONIOCELTIS. Staminate flowers in lax cymes from the axils of caducous bud-scales. Pistillate flowers in several flowered fascicles from the axils of young leaves; stigmas linear, undivided. Leaves deciduous or semipersistent. Unarmed trees of the West Indies, southern continental Asia, Ceylon, and the islands of the Indian Archipelago.

SOLENOSTIGMA. Staminate flowers in many-flowered cymes. Pistillate flowers usually solitary; stigmas generally contracted and bifid or twice bifid at the apex. Leaves coriaceous, entire, usually persistent. Unarmed trees and shrubs of the Old World, principally of the tropics.

MOMISIA. Flowers in many-flowered dense cymes; stigmas linear, bifid. Leaves entire or serrate, deciduous or persistent. Trees or shrubs of the tropical and subtropical regions of the New World usually furnished with axillary spines.

species being distinguishable.[1] Four species inhabit North America; of these two are shrubs which reach the northern limits of their range within the southern border of the United States, one[2] in Florida, and the other[3] in Florida and along the Mexican boundary, where it is distributed from the valley of the lower Rio Grande to southern Arizona. The type is an ancient one, and what are believed to be the traces of several species of Celtis have been found in the miocene rocks of Europe.[4]

Celtis produces straight-grained tough light-colored wood, and that of some species, especially the North American *Celtis occidentalis* and the European and Asiatic *Celtis australis*,[5] is valued in the arts.

In North America numerous insects prey upon Celtis,[6] which is also attacked by several fungal diseases.[7]

[1] Humboldt, Bonpland & Kunth, *Nov. Gen. et Spec.* ii. 30 (Mertensia). — Kunth, *Syn. Pl. Æquin.* i. 367. — Blume, *Bijdr. Fl. Ned. Ind.* ii. 485; *Mus. Bot. Lugd. Bat.* ii. 66 (Solenostigma), 69 (Momisia), 70 (Celtis). — Blanco, *Fl. Filip.* 197. — Spach, *Ann. Sci. Nat.* sér. 2, xvi. 34. — Planchon, *Ann. Sci. Nat.* sér. 3, x. 262; *De Candolle Prodr.* xvii. 168. — Miquel, *Martius Fl. Brasil.* iv. pt. i. 173; *Fl. Ind. Bat.* i. pt. ii. 220. — Grisebach, *Fl. Brit. W. Ind.* 149; *Cat. Pl. Cub.* 57. — Thwaites, *Enum. Pl. Zeylan.* 267. — Parlatore, *Fl. Ital.* iv. 354. — Maximowicz, *Bull. Acad. Sci. St. Pétersbourg*, xviii. 293 (*Mél. Biol.* ix. 27). — Bentham, *Fl. Austral.* vi. 155. — Franchet & Savatier, *Enum. Pl. Jap.* i. 431. — Parodi, *Anal. Soc. Cient. Argent.* v. 94 (*Contrib. Fl. Paragua*, 43). — Boissier, *Fl. Orient.* iv. 1156. — Hemsley, *Bot. Biol. Am. Cent.* iii. 138. — Franchet, *Nouv. Arch. Mus.* sér. 2, v. 268 (*Pl. David.* i.). — Warburg, *Bot. Jahrb.* xiii. 287 (*Papuanische Flora*). — Hooker f. *Fl. Brit. Ind.* v. 481. — Forbes & Hemsley, *Jour. Linn. Soc.* xxvi. 449.

[2] *Celtis Tala*, ε *pallida*, Planchon, *De Candolle Prodr. l. c.* 191 (1873). — Hemsley, *l. c.* 139.

Celtis pallida, Torrey, *Bot. Mex. Bound. Surv.* 203, t. 50 (1859). — Coulter, *Contrib. U. S. Nat. Herb.* ii. 407 (*Man. Pl. W. Texas*).

In September, 1878, Dr. A. P. Garber discovered *Celtis Tala* var. *pallida* on the shores of Lastero Bay, Florida.

[3] *Celtis iguanæus*.

Rhamnus iguanæus, Jacquin, *Enum. Pl. Carib.* 16 (1760). — Linnæus, *Spec.* ed. 2, 282. — Cavanilles, *Icon.* iii. 48, t. 294.

Celtis aculeata, Swartz, *Prodr.* 53 (1788); *Fl. Ind. Occ.* i. 545. — Willdenow, *Spec.* iv. pt. ii. 998. — Miquel, *Martius Fl. Brasil.* iv. pt. i. 173. — Grisebach, *Fl. Brit. W. Ind.* 149. — Planchon, *l. c.* 156. — Hemsley, *l. c.*

Zizyphus iguanea, Lamarck, *Dict.* iii. 318 (1789).

Celtis rhamnoides, Willdenow, *l. c.* (1805).

Mertensia zizyphoides, Humboldt, Bonpland & Kunth, *l. c.* 31 (1817).

Zizyphus commutata, Roemer & Schultes, *Syst.* v. 336 (1819).

Mertensia rhamnoides, Roemer & Schultes, *l. c.* vi. 313 (1820).

Momisia Ehrenbergiana, Klotzsch, *Linnæa*, xx. 538 (1847).

Momisia aculeata, Klotzsch, *l. c.* 539 (1847).

Celtis Ehrenbergiana, Liebmann, *Dansk. Vidensk. Selsk. Skrift.* ser. 5, ii. 339 (1851).

Celtis iguanæus was collected on November 24, 1891, on Terra Ceia Island, Florida, by J. H. Simpson.

[4] Saporta, *Origine Paléontologique des Arbres*, 208. — Zittel, *Handb. Palæontolog.* ii. 474. — Lesquereux, *U. S. Geolog. Surv.* vii. 191 (*Contrib. Foss. Fl. Western Territories*, ii.).

[5] Linnæus, *Spec.* 1043 (1753). — Planchon, *Ann. Sci. Nat. l. c.* 283; *De Candolle Prodr. l. c.* 169. — Boissier, *l. c.* 1156. — Hooker f. *l. c.* 482.

Celtis Caucasica, Willdenow, *l. c.* 994 (1805). — Planchon, *Ann. Sci. Nat. l. c.* 284; *De Candolle Prodr. l. c.* 170. — Boissier, *l. c.*

Celtis Acata, Hamilton *Trans. Linn. Soc.* xvii. 211 (1837).

Celtis eriocarpa, Decaisne, *Jacquemont Voy.* iv. 150, t. 152 (1840).

Celtis australis is a tree of medium size distributed from Spain and northern Africa to Afghanistan and the Himalayas of northwestern India. In southern Europe it is planted in coppice, and from the wood hoops and oars are made; in the mountainous regions of India it is frequently planted as a shade-tree and for the fodder obtained from the leaves and young shoots; the sweet insipid flesh of the fruit is often eaten (Brandis, *Forest Fl. Brit. Ind.* 429. — Gamble, *Man. Indian Timbers*, 343).

[6] In the Fifth Report of the United States Entomological Commission, 1890, forty-four species of insects were designated as preying upon Celtis in North America, and the enumeration is not complete. Of borers attacking these trees little is known. A bark borer, *Scolytus Fagi*, Walsh, is sometimes abundant and destructive in the southern and western states, penetrating the solid wood and hastening its decay; probably, however, it never attacks perfectly healthy trees. *Graphisurus triangulifer*, Haldeman, *Romaleum atomarium*, Drury, and other beetles injure the bark and wood of Celtis, although the injury which they inflict is principally upon dead or diseased trees. One or two species of Mallodon are said to bore into living trees, *Mallodon melanopus*, Linnæus, being capable of doing much injury.

Various general feeding insects injure the foliage of Celtis, and several species of leaf-eaters appear to be peculiar to the genus; the most interesting of these are the butterflies, *Apatura Celtis*, Boisduval & Leconte, *Apatura Clyton*, Boisduval & Leconte, and *Libythea Bachmanni*, Kirtland; and a moth, *Acronycta rubricoma*, Guénée. Among leaf-miners, *Lithocolletis celtifoliella*, Chambers, and *Lithocolletis celtisella*, Chambers, are sometimes abundant. The most remarkable insects infesting Celtis in North America are species of Psyllidæ belonging to the order of Hemiptera. These form peculiar galls on the twigs and leaves, and are often very abundant and injurious. *Pachypsylla Celtidis-gemma*, Riley, causes the buds on twigs to become rounded and irregularly distorted, preventing their growth and the development of branches. *Pachypsylla Celtidis-mamma*, Riley, produces large mammæ-like galls on the under surface of the leaves, often in such abundance as to disfigure the trees; *Pachypsylla Celtidis-vesiculum*, Riley, forms flat blister-like yellowish galls which sometimes become confluent; and *Pachypsylla venusta*, Osten Sacken, produces large galls on the petioles. Several species of peculiar Cecidomyidous galls found on Celtis have been described, although little is known of the insects which cause them.

[7] In North America Celtis is attacked by a comparatively small number of fungi, although from a mycological point of view several of them are interesting, especially those which belong to the order of Leaf Mildews or Erysiphaceæ. *Uncinula polychæta*, Berkeley & Curtis, forms a web-like mould on the leaves, and curious knots

Celtis, the name given by Pliny to a species of Lotus, was adopted by Tournefort[1] and afterwards by Linnæus for this genus.

or distortions have frequently been found on Celtis in Kansas, Texas, Iowa, and Ohio, and occasionally in the eastern states. These unsightly distortions of the ends of the branches have been attributed to the action of a gall-mite, Phytoptus, but associated with it is a fungus, *Sphærotheca phytoptophila*, Kellerman & Swingle (*Journal of Mycology*, iv. 93. — *Trans. Kansas Acad. Sci.* xii. 101. — Kellerman, *Rep. Kansas Experiment Station*, i. 302, t. 4–6. — *Garden and Forest*, iii. 138); and whether the distortions are due entirely to the action of the insects or to the combined action of insects and fungi has not yet been satisfactorily determined. The knots occur both on trees cultivated in the streets of towns for shade and on those growing in the forest. A black mould, *Gyroceras Celtidis*, Montagne & Cesati, a native of Europe, has also been observed on the American species in some of the western states. *Phleospora Celtidis*, Ellis & Martin, *Phyllosticta Celtidis*, Ellis & Kellerman, *Ramularia Celtidis*, Ellis & Kellerman, and *Glœosporium Celtidis*, Ellis & Everhart, produce spots on the leaves and are injurious parasites.

[1] *Inst.* 612, t. 383.

CONSPECTUS OF THE NORTH AMERICAN ARBORESCENT SPECIES.

EUCELTIS. Pedicels ebracteolulate. Staminate flowers articulate, in few-flowered clusters, in the axils of caducous bud-scales; pistillate flowers usually solitary in the axils of lower leaves of the year; stigmas undivided; leaves deciduous; branchlets unarmed, marked with scattered pale lenticels, and at the nodes with obscure ring-like stipular scars.

Leaves ovate to ovate-lanceolate, sharply and coarsely serrate; fruit large	1. CELTIS OCCIDENTALIS.
Leaves ovate-lanceolate, ovate or oblong-lanceolate, entire or occasionally obscurely and remotely serrate, thin or in one form subcoriaceous; fruit small	2. CELTIS MISSISSIPPIENSIS.

CELTIS OCCIDENTALIS.

Hackberry. Sugarberry.

LEAVES ovate to ovate-lanceolate, sharply and coarsely serrate. Fruit large.

Celtis occidentalis, Linnæus, *Spec.* 1044 (1753). — Miller, *Dict.* ed. 8, No. 2. — Du Roi, *Harbk. Baumz.* i. 141. — Moench, *Bäume Weiss.* 20. — Marshall, *Arbust. Am.* 29. — Wangenheim, *Nordam. Holz.* 48. — Gærtner, *Fruct.* i. 374, t. 77. — Walter, *Fl. Car.* 250. — Aiton, *Hort. Kew.* iii. 437. — Willdenow, *Berl. Baumz.* 57; *Spec.* iv. pt. ii. 994; *Enum.* 1046. — Lamarck, *Dict.* iv. 137; *Ill.* iii. 437, t. 844, f. 1. — Abbot, *Insects of Georgia*, i. t. 36. — *Nouveau Duhamel*, ii. 36, t. 9. — Castiglioni, *Viag. negli Stati Uniti*, ii. 220. — Borkhausen, *Handb. Forstbot.* ii. 1093. — Michaux, *Fl. Bor.-Am.* ii. 249. — Persoon, *Syn.* i. 292. — Schkuhr, *Handb.* iv. 343. — Desfontaines, *Hist. Arb.* ii. 448. — Du Mont de Courset, *Bot. Cult.* ed. 2, vi. 389. — Stokes, *Bot. Mat. Med.* ii. 41. — Michaux f. *Hist. Arb. Am.* iii. 225, t. 8. — Pursh, *Fl. Am. Sept.* i. 200. — Nuttall, *Gen.* i. 202. — Roemer & Schultes, *Syst.* vi. 306. — Schmidt, *Oestr. Baumz.* iv. 13, t. 191. — Hayne, *Dendr. Fl.* 216. — Elliott, *Sk.* ii. 584. — Guimpel, Otto & Hayne, *Abbild. Holz.* 119, t. 96. — Sprengel, *Syst.* i. 932. — Watson, *Dendr. Brit.* ii. 147, t. 147. — Rafinesque, *New Fl.* iii. 32. — Loudon, *Arb. Brit.* iii. 1417, t. — Bigelow, *Fl. Boston.* ed. 3, 401. — Dietrich, *Syn.* ii. 991. — Hooker, *Fl. Bor.-Am.* ii. 142. — Spach, *Ann. Sci. Nat.* sér. 2, xvi. 40; *Hist. Vég.* xi. 133. — Schnizlein, *Icon.* t. 91. — Torrey, *Fl. N. Y.* ii. 167. — Planchon, *Ann. Sci. Nat.* sér. 3, x. 288; *De Candolle Prodr.* xvii. 174. — Walpers, *Ann.* iii. 396. — Richardson, *Arctic Exped.* ii. 309. — Darlington, *Fl. Cestr.* ed. 3, 256. — Curtis, *Rep. Geolog. Surv. N. Car.* 1860, iii. 61. — Chapman, *Fl.* 417. — Koch, *Dendr.* ii. 432. — Emerson, *Trees Mass.* ed. 2, 344, t. — Lauche, *Deutsche Dendr.* 353. — Sargent, *Forest Trees N. Am.* 10*th Census U. S.* ix. 125; *Garden and Forest*, iii. 39, f. 7, 8, 13. — Engler, *Engler & Prantl Pflanzenfam.* iii. pt. i. f. 46, F, G. — Watson & Coulter, *Gray's Man.* ed. 6, 463. — Dippel, *Handb. Laubholzk.* ii. 43. — Coulter, *Contrib. U. S. Nat. Herb.* ii. 407 (*Man. Pl. W. Texas*).

Celtis obliqua, Moench, *Meth.* 344 (1794).

Celtis procera, Salisbury, *Prodr.* 175 (1796).

Celtis crassifolia, Lamarck, *Dict.* iv. 138 (1797). — *Nouveau Duhamel*, ii. 37. — Michaux f. *Hist. Arb. Am.* iii. 228, t. 9. — Pursh, *Fl. Am. Sept.* i. 200. — Nuttall, *Gen.* i. 202. — Roemer & Schultes, *Syst.* vi. 307. — Sprengel, *Syst.* i. 932. — Rafinesque, *New Fl.* iii. 35. — Loudon, *Arb. Brit.* iii. 1418, f. 1254. — Dietrich, *Syn.* ii. 991. — Spach, *Ann. Sci. Nat.* sér. 2, xvi. 39; *Hist. Vég.* xi. 130. — Emerson, *Trees Mass.* ed. 2, ii. 347, t.

Celtis occidentalis, var. **tenuifolia**, Persoon, *Syn.* i. 292 (1805). — Koehne, *Deutsche Dendr.* 138. — Dippel, *Handb. Laubholzk.* ii. 46.

Celtis cordata, Persoon, *Syn.* i. 292 (1805). — Schkuhr, *Handb.* iv. 344, t. 355. — Desfontaines, *Hist. Arb.* ii. 448. — Du Mont de Courset, *Bot. Cult.* ed. 2, vi. 389.

Celtis occidentalis, var. **scabriuscula**, Willdenow, *Spec.* iv. pt. ii. 995 (1805); *Berl. Baumz.* ed. 2, 82. — Hayne, *Dendr. Fl.* 217. — Loudon, *Arb. Brit.* iii. 1417.

Celtis occidentalis, var. **cordata**, Willdenow, *Berl. Baumz.* ed. 2, 82 (1811). — Hayne, *Dendr. Fl.* 217. — Roemer & Schultes, *Syst.* vi. 307. — Loudon, *Arb. Brit.* iii. 1417.

Celtis canina, Rafinesque, *Am. Monthl. Mag. and Crit. Rev.* ii. 43 (1817).

Celtis maritima, Rafinesque, *Am. Monthl. Mag. and Crit. Rev.* ii. 44 (1817); *New Fl.* iii. 35.

Celtis tenuifolia, Nuttall, *Gen.* i. 202 (1818); *Sylva*, i. 135. — Rafinesque, *New Fl.* iii. 36.

? Celtis grandidentata, Tenore, *Ind. Sem. Hort. Neap.* 15 (1833).

Celtis morifolia, Rafinesque, *New Fl.* iii. 34 (1836).

Celtis heterophylla, Rafinesque, *New Fl.* iii. 37 (1836).

Celtis patula, Rafinesque, *New Fl.* iii. 37 (1836).

Celtis Floridana, Rafinesque, *New Fl.* iii. 37 (1836).

Celtis crassifolia, var. **tiliæfolia**, Spach, *Ann. Sci. Nat.* sér. 2, xvi. 39 (1841); *Hist. Vég.* xi. 131. — Walpers, *Ann.* iii. 396.

Celtis crassifolia, var. **morifolia**, Spach, *Ann. Sci. Nat.* sér. 2, xvi. 39 (1841); *Hist. Vég.* xi. 131. — Walpers *Ann.* iii. 396.

Celtis crassifolia, var. **eucalyptifolia**, Spach, *Ann. Sci. Nat.* sér. 2, xvi. 40 (1841); *Hist. Vég.* xi. 131. — Walpers, *Ann.* iii. 396.

? Celtis occidentalis, var. **grandidentata**, Spach, *Ann. Sci. Nat.* sér. 2, xvi. 40 (1841); *Hist. Vég.* xi. 133. — Walpers, *Ann.* iii. 396.

Celtis occidentalis, var. **serrulata**, Spach, *Ann. Sci. Nat.* sér. 2, xvi. 41 (1841); *Hist. Vég.* xi. 134. — Walpers, *Ann.* iii. 396.

Celtis Audibertiana, Spach, *Ann. Sci. Nat.* sér. 2, xvi. 41 (1841); *Hist. Vég.* xi. 135. — Planchon, *De Candolle Prodr.* xvii. 174.

Celtis Audibertiana, var. **ovata**, Spach, *Ann. Sci. Nat.* sér. 2, xvi. 41 (1841); *Hist. Vég.* xi. 135.

Celtis Audibertiana, var. **oblongata**, Spach, *Ann. Sci. Nat.* sér. 2, xvi. 41 (1841); *Hist. Vég.* xi. 135.

Celtis Douglasii, Planchon, *Ann. Sci. Nat.* sér. 3, x. 293

(1848); *De Candolle Prodr.* xvii. 178. — Walpers, *Ann.* iii. 396.

Celtis occidentalis, var. crassifolia, Gray, *Man.* ed. 2, 397 (1856). — Koch, *Dendr.* ii. 433.

Celtis reticulata, Cooper, *Am. Nat.* iii. 407 (not Torrey) (1869). — Hall, *Bot. Gazette*, ii. 93.

Celtis occidentalis, var. **Audibertiana**, Koch, *Dendr.* ii. 433 (1872). — Dippel, *Handb. Laubholzk.* ii. 43.

? Celtis occidentalis, c **grandidentata**, Dippel, *Handb. Laubholzk.* ii. 44 (1892).

A tree, sometimes a hundred and thirty feet in height, with a straight slender trunk two and a half to three feet in diameter, and often free of branches for seventy or eighty feet; usually much smaller, and in the eastern states generally short-trunked, with stout spreading ridged or frequently pendulous branches, which form a handsome round-topped head. The bark of the trunk is an inch to an inch and a half in thickness, and is light brown or silvery gray, broken on the surface into thick appressed scales, and sometimes roughened with irregular wart-like excrescences or ridges, which also appear on the large branches. The branchlets, which are slender and slightly zigzag, and contain a thick light-colored pith, are light green when they first appear, and glabrous or puberulous; they gradually become tinged with red, and in their first winter are bright red-brown and rather lustrous, and are marked with horizontal semi-oval or oblong leaf-scars in which appear the ends of three fibro-vascular bundles; they grow darker in their second or third year, when they become dark brown slightly tinged with red. The buds are axillary,[1] ovate, pointed, flattened by the pressure of the stem, about a quarter of an inch long, and covered by three pairs of chestnut-brown ovate acute pubescent caducous scales loosely imbricated in two ranks, increasing in size from without inward and gradually passing into the stipules of the lower leaves. The leaves are conduplicate in the bud, with slightly involute margins, each leaf being inclosed by its stipules; they are broadly ovate, more or less falcate, gradually or abruptly contracted into long narrow points, rounded and usually very oblique at the base, serrate with coarse incurved callous-tipped teeth, except at the ends which are mostly entire, and three-ribbed; when they unfold they are pale yellow-green, coated on the lower surface and on the petioles with soft silky white hairs, and pilose on the upper surface; and at maturity they are thin, light green and lustrous, smooth, scabrate or scabrous above, and paler and glabrous or slightly hairy below on the prominent midribs and primary veins which are arcuate and united near the margins and connected by conspicuous reticulate thick veinlets; they are two and a half inches to four inches long and one to two inches wide, and are borne on slender slightly grooved hairy petioles one half to two thirds of an inch in length. The stipules are caducous, linear-strap-shaped, white and scarious and nearly half an inch long, or on sterile shoots they are ovate, acute, concave, and sometimes two thirds of an inch long and a quarter of an inch wide. The leaves turn to a light yellow color late in the autumn before falling. The flowers appear in early spring soon after the unfolding of the leaves, and are borne on slender drooping pedicels. The calyx is light yellow-green, and is divided nearly to the base, usually into five linear acute thin and scarious lobes rounded on the back, and more or less laciniately cut at the apex, which is tinged with red and often tipped with a tuft of pale hairs. In the sterile flower the stamens are inserted on the margin of the thickened torus, which is coated with thick white tomentum; the filaments are white, glabrous, slightly flattened, and gradually narrowed from the base to the apex; before anthesis they are incurved above the middle, the anthers being face to face in the bud, and, straightening abruptly as the flower opens, they become slightly incurved and exserted; the anthers are oblong, emarginate, and attached on the back below the middle, and are extrorse, nodding rather obliquely on the expanded filaments; in the perfect flower the filaments are slightly incurved in the bud, but do not straighten or lengthen after anthesis, the anthers remaining erect and included or slightly exserted from the calyx. The ovary of the perfect flower is oblong-ovate, sessile on the discoid torus, which is covered with white

[1] The North American species of Euceltis, like Ulmus, do not form a terminal bud, the end of the branch withering and falling off during the summer, leaving a minute orbicular scar close to the upper axillary bud, which prolongs the branch the following season (Foerste, *Bull. Torrey Bot. Club*, xx. 163, t. 147, f. 11).

tomentum, bright green, glabrous, and very lustrous; in the staminate flower it is reduced to a minute point; the stigmas, which are covered with white papillæ, and are a quarter of an inch across when expanded, mature before the filaments of the staminate flowers begin to straighten. The fruit is oblong, one half to three quarters of an inch in length, tipped with the remnants of the style, and dark purple; it consists of a thick tough skin, thin dry orange-colored flesh, and a smooth thick-walled oblong pointed apiculate light brown nutlet, deep orange-color and lustrous on the inner surface. The seed is covered with a thin membranaceous light brown coat marked at the chalaza with a large dark circular spot. The fruit hangs on a slender stem one half to three quarters of an inch long and slightly enlarged at the apex, from which it separates in falling; it ripens in September and October, and, unless eaten by birds, often remains on the branches during the winter.

In Canada, where *Celtis occidentalis* is exceedingly rare and local,[1] it is distributed from Saint Helen's Island in the St. Lawrence River, near Montreal, westward to southern Ontario, and in the United States from the shores of Massachusetts Bay to northwestern Nebraska,[2] North Dakota, southern Idaho,[3] eastern Washington and Oregon,[4] western Washington,[5] the East Humboldt Mountains of Nevada,[6] New Mexico,[7] and southward to the shores of Bay Biscayne and Cape Romano in Florida, and to Missouri, eastern Kansas, Arkansas, the Indian Territory, and eastern Texas. Rare east of the Hudson River, *Celtis occidentalis* becomes more abundant in western New York and the middle states, and attains its greatest size on the rich bottom-lands of the lower Ohio basin, where it is one of the commonest trees in the forests of Oaks, Hickories, and Walnuts;[8] it grows usually in rich moist soil, and often, especially in the east, on dry gravelly or rocky hillsides. West of the Rocky Mountains it is exceedingly rare, and is confined to the banks of streams in positions where it is frequently inundated during periods of high water, and where it is a small tree or shrub rarely thirty feet tall, with thick rigid scabrous conspicuously reticulate leaves. On the rocky banks of streams a dwarf shrubby form[9] with stems four to ten feet tall and small usually rugose leaves is not uncommon in the south Atlantic states, from which it ranges westward to Missouri, Colorado, Utah, and Nevada.

The wood of *Celtis occidentalis* is heavy, rather soft, not strong, and coarse-grained, containing bands of several rows of large open ducts marking the layers of annual growth, numerous small groups of smaller ducts arranged in intermediate concentric rings, and many thin medullary rays; it is clear light yellow, with thick lighter colored sapwood. The specific gravity of the absolutely dry wood is 0.7287, a cubic foot weighing 45.41 pounds. It is largely used for fencing and for cheap furniture.

Celtis occidentalis was introduced into English gardens by the younger Tradescant[10] about the middle of the seventeenth century, and the first description of it, made from a plant cultivated in England, was published in 1688 in Ray's *Historia Plantarum*.[11]

A tall stately tree in the basin of the Ohio River, where its slender shafts covered with smooth pale bark enliven the forests which clothe the banks of streams and rich intervale lands, the Hackberry[12]

[1] Brunet, *Cat. Vég. Lig. Can.* 45. — Macoun, *Cat. Can. Pl.* 429.

[2] Bessey, *Rep. Nebraska State Board Agric.* 1894, 105.

[3] *Celtis occidentalis* was found by Dr. J. E. Wilcox, U. S. A., near Boisé City, Idaho, in 1881.

[4] It was discovered in the valley of the Snake River by David Douglas early in the present century.

[5] By the naturalists attached to the United States Exploring Expedition under command of Commodore Wilkes, it was discovered on the shore of Puget Sound (Torrey, *Bot. Wilkes Explor. Exped.* 456).

[6] Watson, *King's Rep.* 321 (var. *pumila*).

[7] Fendler, *Plantæ Nova-Mexicanæ*, No. 775.

[8] Ridgway, *Proc. U. S. Nat. Mus.* 1882, 72.

[9] *Celtis occidentalis*, var. *pumila*, Gray, *Man.* ed. 2, 397 (1856). — Curtis, *Rep. Geolog. Surv. N. Car.* 1860, iii. 62. — Chapman, *Fl.* 417. — Koch, *Dendr.* ii. 434. — Watson & Coulter, *Gray's Man.* ed. 6, 436. — Koehne, *Deutsche Dendr.* 137. — Dippel, *Handb. Laubholzk.* ii. 44.

Celtis pumila, Pursh, *Fl. Am. Sept.* i. 200 (1814). — Roemer & Schultes, *Syst.* iii. 307. — Rafinesque, *New Fl.* iii. 36. — Loudon, *Arb. Brit.* iii. 1420. — Gray, *Man.* 400.

[10] See i. 20.

[11] *Lotus arbor Virginiana fructu rubro*, ii. 1917.

[12] In the eastern states *Celtis occidentalis* is sometimes called Nettle-tree or False Elm; as it is also called Hogberry and Dog Cherry.

Celtis fructu obscure purpurascente, Tournefort, *Inst.* 612. — Miller, *Dict.* No. 1; *Dict. Icon.* i. 59, t. 88. — Duhamel, *Traité des Arbres*, i. 143.

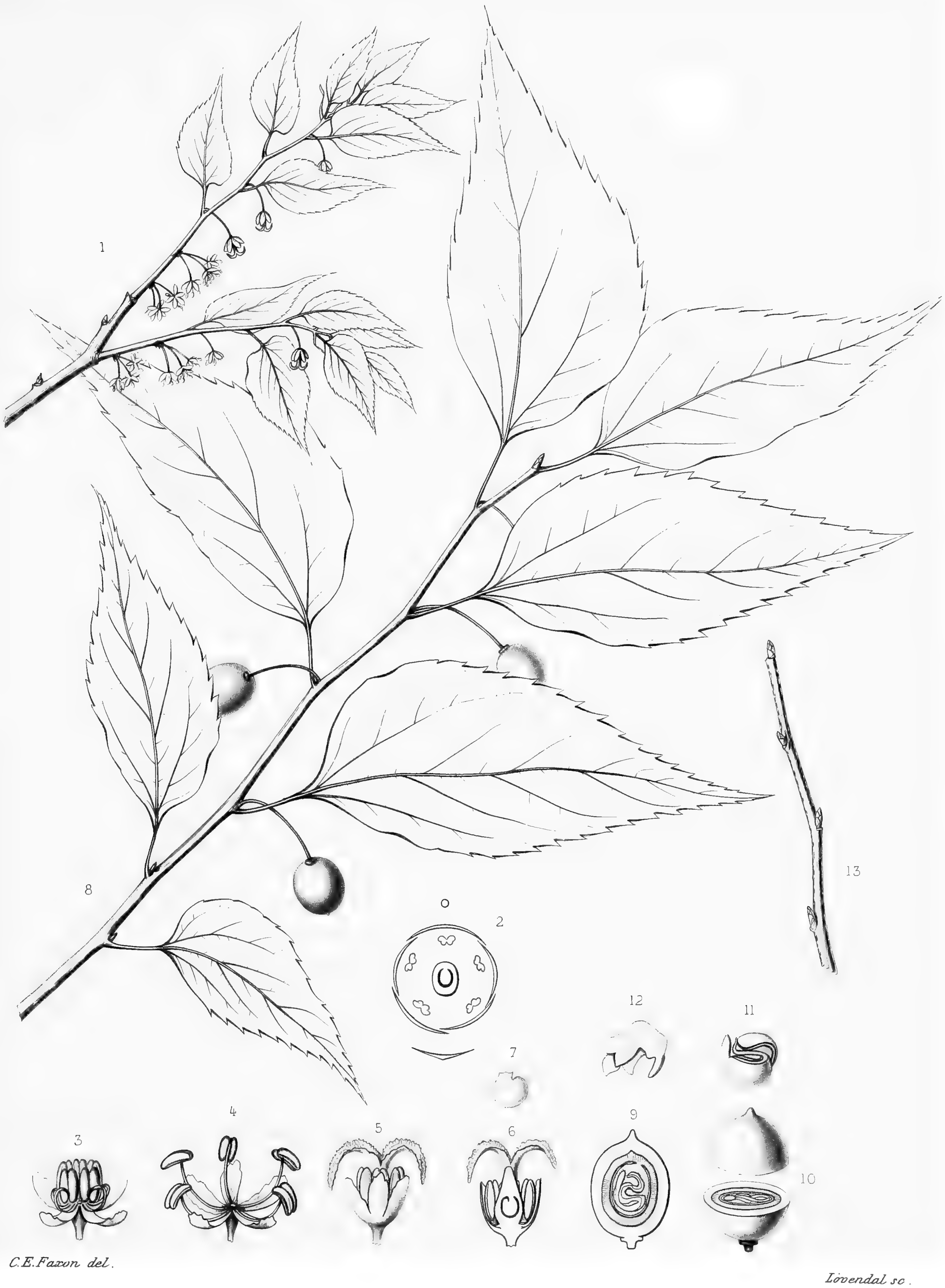
Celtis procera, foliis ovate-lanceolatis, serratis; fructu pullo, Clayton, *Fl. Virgin.* 195.

is perhaps as beautiful in less favored regions, with its shorter trunk, broad head of graceful branches, and dense light green foliage. Few North American trees are better suited to adorn parks or highways; and its value as an ornamental tree is increased by its rapid growth under varied conditions of climate and soil, its resistance to drought, and its freedom from serious diseases and the injuries caused by insects. The Hackberry is now often planted as a shade-tree in some of the states between the Missouri River and the Rocky Mountains, and occasionally in other parts of the United States and in Europe. It can be raised from seed without difficulty; and its abundant fibrous roots make the operation of transplanting it easy and safe.

EXPLANATION OF THE PLATE.

PLATE CCCXVII. CELTIS OCCIDENTALIS.

1. A flowering branch, natural size.
2. Diagram of a flower.
3. A staminate flower before the straightening of the filaments, enlarged.
4. A staminate flower expanded, enlarged.
5. A perfect flower, enlarged.
6. Vertical section of a perfect flower, enlarged.
7. An ovule, much magnified.
8. A fruiting branch, natural size.
9. Vertical section of a fruit, enlarged.
10. A fruit cut open transversely, enlarged.
11. An embryo, enlarged.
12. An embryo partly displayed, enlarged.
13. A winter branchlet, natural size.



C.E.Faxon del.

Lovendal sc.

CELTIS OCCIDENTALIS, L.

A.Riocreux direx.t

Imp J.Taneur, Paris.

CELTIS MISSISSIPPIENSIS.

Sugarberry. Hackberry.

LEAVES ovate-lanceolate, ovate, or oblong-lanceolate, entire or occasionally obscurely and remotely serrate. Fruit small.

Celtis Mississippiensis, Bosc, *Dict. Agric.* nouv. éd. x. 41 (1810). — Spach, *Ann. Sci. Nat.* sér. 2, xvi. 42; *Hist. Vég.* xi. 136. — Planchon, *Ann. Sci. Nat.* sér. 3, x. 287; *De Candolle Prodr.* xvii. 176. — Walpers, *Ann.* iii. 395. — Watson & Coulter, *Gray's Man.* ed. 6, 463, 734. — Coulter, *Contrib. U. S. Nat. Herb.* ii. 407 (*Man. Pl. W. Texas*).

Celtis lævigata, Willdenow, *Berl. Baumz.* ed. 2, 81 (1811); *Enum.* Suppl. 68. — Roemer & Schultes, *Syst.* vi. 306. — Sprengel, *Syst.* i. 932. — Rafinesque, *New Fl.* iii. 34. — Loudon, *Arb. Brit.* iii. 1420. — Dietrich, *Syn.* ii. 991. — Koch, *Dendr.* ii. 432.

Celtis alba, Rafinesque, *Fl. Ludovic.* 25 (1817); *New Fl.* iii. 32. — Planchon, *De Candolle Prodr.* xvii. 177. — Hemsley, *Bot. Biol. Am. Cent.* iii. 139.

Celtis occidentalis, var. **integrifolia**, Nuttall, *Gen.* i. 202 (1818). — Chapman, *Fl.* 417.

Celtis longifolia, Rafinesque, *Fl. Tex.* 22 (1833). — Nuttall, *Sylva*, i. 34, t. 40. — Planchon, *De Candolle Prodr.* xvii. 177.

Celtis fuscata, Rafinesque, *New Fl.* iii. 33 (1836).

Celtis integrifolia, Nuttall, *Trans. Am. Phil. Soc.* n. ser. v. 169 (not Lamarck) (1837).

Celtis Berlandieri, Klotzsch, *Linnæa*, xx. 541 (1847). — Planchon, *De Candolle Prodr.* xvii. 179. — Hemsley, *Bot. Biol. Am. Cent.* iii. 139.

Celtis Texana, Scheele, *Linnæa*, xxii. 146 (1849); *Roemer Texas*, 446.

Celtis Lindheimeri, Koch, *Dendr.* ii. 434 (1872).

Celtis occidentalis, Sargent, *Forest Trees N. Am.* 10*th Census U. S.* ix. 125 (in part) (not Linnæus) (1884); *Garden and Forest*, iii. 39 (in part), f. 9, 10, 11. — Havard, *Proc. U. S. Nat. Mus.* viii. 506.

A tree, sixty to eighty feet in height, with a short trunk two or three feet in diameter and spreading sometimes pendulous branches which form a broad and often graceful head; often much smaller and sometimes shrubby in habit. The bark of the trunk is one half to two thirds of an inch in thickness, light blue-gray, and covered with prominent excrescences. The branchlets, when they first appear, are light green and glabrous or covered with pale pubescence, and in their first winter are bright reddish brown, rather lustrous and marked with oblong pale lenticels and narrow elevated horizontal leaf-scars in which appear the ends of three fibro-vascular bundles. The buds are ovate, pointed, flattened by the pressure of the stem, from one sixteenth to one eighth of an inch in length, and covered by chestnut-brown puberulous scales. The leaves are ovate or oblong-lanceolate, long-pointed, more or less falcate, unequally rounded and very oblique, or unequally wedge-shaped at the base, entire or occasionally obscurely serrate with minute incurved teeth, or rarely furnished above the middle with one or two broad sharp teeth, and three-ribbed; when they unfold they are light yellow-green and nearly glabrous or coated with pale pubescence, and at maturity they are firm, smooth, and glabrous, dark green on the upper, and pale on the lower surface, three or four inches long and three quarters of an inch to three inches broad, with slender petioles slightly grooved above and from one quarter to one half of an inch in length, narrow yellow ribs impressed above, and slender veins arcuate and united near the margins and connected by conspicuous reticulate veinlets. The stipules are linear-strap-shaped, white and scarious, and coated with soft white hairs. The flowers appear in early spring and are borne on slender hirsute pedicels. The calyx is greenish yellow, divided to the base into five ovate lanceolate glabrous or puberulous scarious lobes which are furnished at the apex with tufts of long white hairs. The filaments are incurved in the bud, slightly flattened and glabrous; in the sterile flower they straighten themselves abruptly and become exserted; and in the perfect flower they are shorter and remain incurved, the anthers after anthesis being included or slightly exserted. The ovary is ovate,

glabrous, green, and lustrous, and is crowned with the spreading white stigmas which open before the stamens of the sterile flowers shed their pollen. The fruit is ovate, one eighth to one quarter of an inch long, and bright orange-red, with thin dry flesh and a smooth light brown nut. The seed is light brown and marked with a large dark spot at the chalaza.

Celtis Mississippiensis inhabits rich bottom-lands and the banks of streams or occasionally dry limestone hills, and is distributed from southern Indiana and Illinois through Kentucky, Tennessee, and Alabama to the shores of Bay Biscayne in Florida,[1] and through Missouri, Arkansas, and Texas to Nuevo Leon; it also inhabits Bermuda.[2] In the basin of the lower Ohio River, where it is abundant and grows to its largest size,[3] it is often found associated with *Celtis occidentalis*, from which it may be distinguished by its smaller size and proportionately shorter trunk, by the larger and more numerous excrescences which cover its bark, by its narrower and usually entire leaves, and its smaller bright orange-red fruit. In Kentucky and Tennessee *Celtis Mississippiensis* is the most common species; rare in the Gulf states, it is exceedingly common west of the Mississippi River, especially in Arkansas, Louisiana, Texas, and Nuevo Leon, where in the valley of the Rio Grande it forms broad heads of long graceful pendulous branches.

The wood of *Celtis Mississippiensis* is rather soft, not strong, and close-grained, and contains bands of several rows of large open ducts marking the layers of annual growth, groups of smaller ducts arranged in intermediate concentric rings, and thin medullary rays; it is light clear yellow, with thick lighter colored sapwood. The specific gravity of the absolutely dry wood is 0.7956, a cubic foot weighing 49.57 pounds. Confounded in commerce with the wood of *Celtis occidentalis*, it is used for the same purposes.

In Texas *Celtis Mississippiensis* gradually passes into the variety *reticulata*;[4] this is a small bushy tree forty to fifty feet in height, with stout branches and a short trunk covered with smooth blue-gray bark on which the excrescences are sometimes over an inch high and are usually interrupted or broken into short lengths; or in arid regions it is often reduced to a low shrub. The leaves are broadly ovate, acute or rarely acuminate, rounded or cordate and usually oblique and very unequal at the base, entire or rarely furnished above the middle with a few large teeth, thick and coriaceous, dark green and glabrous or scabrate on the upper surface, and pale and yellow-green, glabrous or hirsute on the lower surface, which is covered with a network of prominent yellow veinlets impressed on the upper side. The fruit varies from one quarter to one half of an inch in length and is dark orange-red.

Celtis Mississippiensis, var. *reticulata*, is distributed from the neighborhood of Dallas in Texas to the Rio Grande, and westward through New Mexico and Arizona to southern Utah and Nevada and the western rim of the Colorado Desert in California, reappearing in Lower California.[5] In eastern Texas it grows usually on dry limestone hills, and farther west near the banks of streams and in mountain cañons.

The specific gravity of the absolutely dry wood of *Celtis Mississippiensis*, var. *reticulata*, is 0.7275, a cubic foot weighing 45.34 pounds.

[1] A. H. Curtiss, *North American Plants*, 1881, No. 172.

[2] Lefroy, *Bull. U. S. Nat. Mus.* No. 25, 41 (*Bot. Bermuda*).

There are a number of Celtis-trees in the Walsingham Tract in Bermuda, in addition to those mentioned by General Lefroy. In the shape, size, and texture of the leaves, which are entire or occasionally furnished with one or two large teeth, and in the size of the fruit, they appear identical with the trees of Bay Biscayne.

[3] Ridgway, *Proc. U. S. Nat. Mus.* 1882, 72.

[4] *Celtis Mississippiensis*, var. *reticulata*.

Celtis reticulata, Torrey, *Ann. Lyc. N. Y.* ii. 247 (1828). — Rafinesque, *New Fl.* iii. 35. — Nuttall, *Sylva*, i. 133, t. 39. — Planchon, *Ann. Sci. Nat.* sér. 3, x. 293; *De Candolle Prodr.* xvii. 178. — Walpers, *Ann.* iii. 396. — Torrey & Gray, *Pacific R. R. Rep.* ii. 175. — Watson, *Cat. Pl. Wheeler*, 16. — Rothrock, *Wheeler's Rep.* vi. 238. — Rusby, *Bull. Torrey Bot. Club*, ix. 54. — Coulter, *Contrib. U. S. Nat. Herb.* ii. 407 (*Man. Pl. W. Texas*).

Celtis brevipes, Watson, *Proc. Am. Acad.* xiv. 297 (1879).

Celtis occidentalis, var. *reticulata*, Sargent, *Forest Trees N. Am. 10th Census U. S.* ix. 126 (1884); *Garden and Forest*, iii. 40, f. 12. — Koehne, *Deutsche Dendr.* 138. — Dippel, *Handb. Laubholzk.* ii. 45. — Coville, *Contrib. U. S. Nat. Herb.* iv. 195 (*Bot. Death Valley Exped.*).

[5] *Celtis Mississippiensis*, var. *reticulata*, was discovered on Cerros Island off the coast of Lower California, in 1872, by Dr. J. A. Veatch; and in the San Julio Cañon on the mainland in April, 1889, by Mr. T. S. Brandegee (*Proc. Cal. Acad.* ser. 2, ii. 205 [*Pl. Baja Cal.*]).

Celtis Mississippiensis was described from a plant cultivated in Paris, where it was probably introduced by the elder Michaux,[1] who was the first botanist to explore the forests of that part of the Mississippi basin where this tree abounds. Its rapid growth, excellent habit, and cheerful foliage, which remains on the branches with slight change of color until the beginning of winter, make it a desirable ornamental tree, and it is now generally used to shade the streets of the cities and towns of central and western Texas.

[1] See i. 58.

EXPLANATION OF THE PLATES.

Plate CCCXVIII. Celtis Mississippiensis.

1. A flowering branch, natural size.
2. A staminate flower just expanding, enlarged.
3. A staminate flower after anthesis, enlarged.
4. A pistillate flower, enlarged.
5. A fruiting branch, natural size.
6. A fruit cut transversely, enlarged.
7. A nutlet, enlarged.
8. A seed, enlarged.
9. A branchlet with lanceolate entire leaves, natural size.
10. A leaf, natural size.
11. A leaf, natural size.
12. A winter branchlet, natural size.
13. A winter-bud and leaf-scar, enlarged.

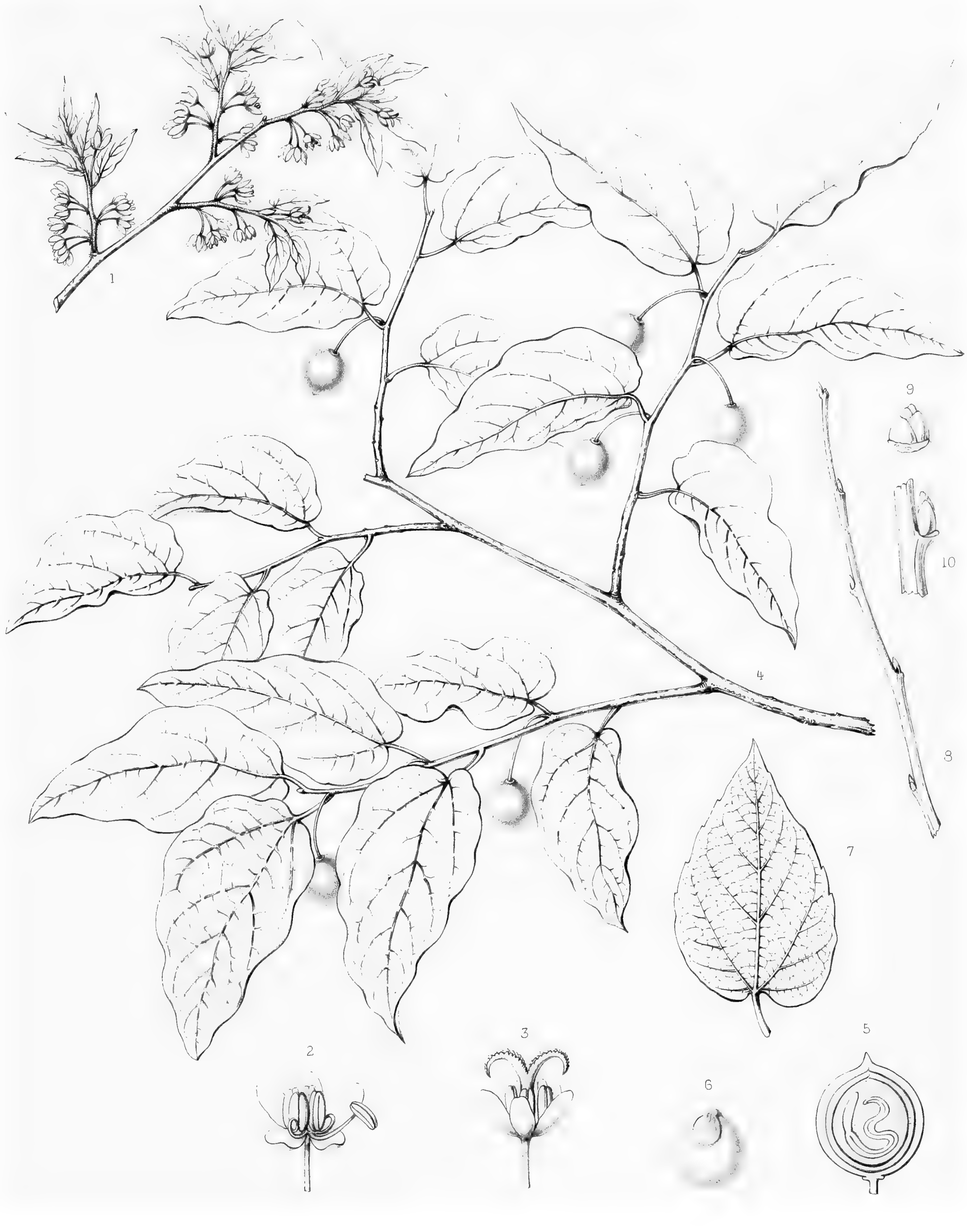
Plate CCCXIX. Celtis Mississippiensis, *var.* reticulata.

1. A flowering branch, natural size.
2. A staminate flower expanding, enlarged.
3. A pistillate flower, enlarged.
4. A fruiting branch, natural size.
5. Vertical section of a fruit, enlarged.
6. A seed, enlarged.
7. Under surface of a leaf, natural size.
8. A winter branchlet, natural size.
9. A winter-bud, and leaf-scar, enlarged.
10. Side view of a winter-bud, enlarged.

C.E.Faxon del. *Himely sc.*

CELTIS MISSISSIPPIENSIS, Bosc.

A.Riocreux direx.t *Imp.J.Taneur, Paris.*



C.E.Faxon del. *Migneaux sc.*

CELTIS MISSISSIPPIENSIS, Var. RETICULATA, Sarg.

A. Riocreux direx.t. *Imp. J. Taneur, Paris.*

MORUS.

FLOWERS monœcious or diœcious; calyx 4-parted, the divisions imbricated in æstivation; corolla 0; stamens 4, incurved in the bud; disk 0; ovary superior, 1-celled; ovule solitary, suspended. Fruit drupaceous, inclosed in the thickened succulent calyx. Leaves alternate, stipulate, deciduous.

Morus, Linnæus, *Gen.* 283 (1737). — Adanson, *Fam. Pl.* ii. 377. — A. L. de Jussieu, *Gen.* 402. — Endlicher, *Gen.* 278. — Meisner, *Gen.* 351. — Baillon, *Hist. Pl.* vi. 190. — Bentham & Hooker, *Gen.* iii. 364. — Engler, *Engler & Prantl Pflanzenfam.* iii. pt. i. 72.

Morophorum, Necker, *Elem. Bot.* iii. 255 (1790).

Trees or shrubs, with thick milky juice, slender terete unarmed branches, scaly bark, and fibrous roots. Buds[1] covered with ovate scales closely imbricated in two ranks, increasing in size from without inward, the inner accrescent, caducous, marking in falling the base of the branch with narrow ring-like scars. Leaves conduplicate in the bud, alternate, serrate, entire or three-lobed, three to five-nerved at the base, petiolate, membranaceous or subcoriaceous, deciduous; stipules inclosing their leaf in the bud, lateral, lanceolate, acute, caducous. Flowers minute, vernal, in pedunculate clusters from the axils of the caducous bud-scales, or of the lower leaves of the year; the males short-pedicellate, in elongated cylindrical spikes; the females sessile, in short oblong or subglobose, or rarely elongated densely flowered spikes; the males and females on different branches of the same individual or on different individuals, or the two sexes rarely mixed in the same inflorescence. Calyx of the sterile flower deeply divided into four equal ovate rounded lobes. Stamens four, inserted opposite the lobes of the calyx under the minute rudimentary ovary; filaments filiform, incurved in the bud, in anthesis straightening elastically, exserted; anthers attached on the back below the middle, erect, two-celled, the cells reniform, attached laterally to the orbicular connective, opening longitudinally. Calyx of the pistillate flower four-parted, the lobes ovate or obovate, thickened, often unequal, the two outer broader than the others, persistent, becoming succulent, and inclosing the fruit. Ovary ovoid or subglobose, sessile, included in the calyx, one-celled, crowned with a central style divided nearly to the base into two equal spreading filiform or subulate villous stigmatic branches; ovule solitary, suspended from the apex of the cell, campylotropous; micropyle superior. Drupes ovate or obovate, crowned with the remnants of the styles, inclosed in the succulent thickened colored perianths and more or less united into an edible juicy syncarp; exocarp subsucculent, thin; endocarp thin or thick, crustaceous.[2] Seed oblong, pendulous; testa thin, membranaceous; hilum minute, apical. Embryo incurved in thick fleshy albumen; cotyledons oblong, equal; radicle ascending, incumbent.

Morus, of which six or seven species can be distinguished, is confined to eastern temperate North America, where two species occur, the elevated regions of Mexico, Central America and western South America, western Asia, India, China, Japan, and the high mountains of the Indian Archipelago. The

[1] The North American, Persian, Chinese, and Japanese species of Morus do not form a terminal bud, the end of the branch dying and falling off during the summer, leaving a scar close to the upper axillary bud, which prolongs the branch (Henry, *Nov. Act. Nat. Cur.* xxii. 306, t. 28. — Foerste, *Bull. Torrey Bot. Club*, xx. 163, t. 147, f. 4).

[2] Baillon, *Adansonia*, i. 214, t. 8, f. 1–12.

most valuable species, *Morus alba*,[1] a native of northern China and the island of Yezo, is cultivated in China and Japan, northwestern India, western Asia, and the countries surrounding the Mediterranean,

[1] Linnæus, *Spec.* 986 (1753). — Reichenbach, *Icon. Fl. Germ.* xii. t. 1327. — Seringe, *Descr. et Cult. Mur.* 191, Atlas, t. 1–18. — Bureau, *De Candolle Prodr.* xvii. 238. — Boissier, *Fl. Orient.* iv. 1153. — Franchet, *Nouv. Arch. Mus.* sér. 2, v. 270 (*Pl. David.* i.). — Forbes & Hemsley, *Jour. Linn. Soc.* xxvi. 455.

Morus Tatarica, Linnæus, *l. c.* (1753). — Pallas, *Fl. Ross.* i. pt. ii. 9, t. 52.

Morus Constantinopolitana, Poiret, *Lam. Dict.* iv. 381 (1797). — *Nouveau Duhamel*, iv. 92, t. 24. — Maximowicz, *Prim. Fl. Amur.* 477.

The wild Mulberry-tree with deeply lobed, irregularly shaped leaves and dark red or nearly black fruit, discovered by the French missionary David on the mountains of southern Mongolia, and common in the mountainous regions of northern China, is believed to be the original type from which have sprung the numerous varieties of this tree which are now cultivated where sericulture is practiced (Julien, *Résumé des Principaux Traités Chinois sur la Culture des Muriers.* — Bretschneider, *Jour. North-China Branch Royal Asiatic Soc.* n. ser. xxv. 329 [*Botanicon Sinicum*, ii.]) ; and the White Mulberry in a form with less uniformly divided leaves than those of the north China tree is certainly wild in the primeval forests which cover the hills of central Yezo.

No other tree furnishes employment, directly and indirectly, to so large a number of the human race, or has been so carefully studied from the cultural point of view ; and no other tree has given rise to such a voluminous literature. The cultivation of the White Mulberry-tree in China to furnish food for the silk-worm (*Bombyx Mori*, Linnæus) is as old as the civilization of the Chinese race ; and there is a tradition printed in the first century before the Christian era that Siling, wife of the Emperor Huang Ti (B. C. 2697), first instructed the people in the art of rearing silk-worms. Long and jealously guarded by the Chinese, the secret of the art of silk-making first reached Japan through Corea in the third century of our era ; during the reign of the twenty-first Mikado (457–479 A. D.) the planting of Mulberry-trees was encouraged, although it was not until the second half of the sixth century that silk-culture became a great national industry in Japan (Rein, *Industries of Japan*, 188). The art of sericulture carried from China to India was first established there in the valley of the Brahmaputra, and the earliest account of the silk-worm in European literature appears in Aristotle (*Hist. Anim.* v. 19 [17] ; 11 [6]), who may have derived his scanty knowledge of it from the Greek soldiers who accompanied Alexander to India. In the year 550 two Nestorian monks carried eggs of the silk-worm from Khotan to the Court of Justinian in Constantinople, and silk-culture, gradually established in the Byzantine Empire, spread through southern Europe, although until the fourteenth century the Black and not the White Mulberry-tree was planted in the countries bordering the Mediterranean to supply the silk-worm with food. (See Loudon, *Arb. Brit.* iii. 1348. — Antonio Targioni-Tozzetti, *Cenni Storici sulla Introduzione di varie Piante nell' Agricoltura ed Orticoltura Toscana*, 188. — A. De Candolle, *Origine des Plantes Cultivées*, 119.)

Early in the sixteenth century the Spaniards made an unsuccessful attempt to establish sericulture in Mexico, and Mulberry-trees and the eggs of the silk-worm were sent from Spain for the purpose ; a century later James I. endeavored to introduce it into the English colonies in North America, and, until the breaking out of the War of the Revolution, persistent efforts were made by the British government to encourage the rearing of silk-worms, especially in Virginia, which seemed to offer particular advantages for this industry (see a pamphlet published in London in 1655, entitled *The Reformed Virginian Silk-Worm, or a rare and new Discovery of a speedy way, and easie means, found out by a young Lady in England, she having made full proof thereof in May anno* 1652. *For feeding of Silk-worms in the Woods, on the Mulberry-tree leaves in Virginia* [Force, *Coll. Hist. Tracts*, iii. No. 13]) ; and in Georgia, where every grant of Crown land was coupled with the condition that one hundred White Mulberry-trees should be planted on each ten acres of ground. (See an *Account, shewing the Progress of the Colony of Georgia, in America, from its first establishment*, 7, London, 1741 [Force, *l. c.* i. No. 5].)

The White Mulberry-tree flourishes in all the eastern United States, and by its hardiness in the severe climate of New England shows its northern origin. In a description of the province of South Carolina in 1731, a White Mulberry-tree seven or eight years old, growing at Port Royal, is said to have had a trunk five feet in circumference, and several other trees only five years old with trunks a foot in diameter are described. (See Force, *l. c.* ii. No. 10.) Sericulture, however, has never become an American industry, although various attempts to make it so have been tried in the United States by individuals or through bounties offered by the state governments. Climatic conditions favor the industry, but the high price of labor has made it unprofitable. Sixty years ago the hope of establishing it in the United States caused the greatest horticultural speculation the country has known, and ruined thousands of people. In 1824 a French traveler brought to France under the name of *Morus multicaulis* (Perrottet, *Ann. Soc. Linn.* Paris, 1829, 129. — Seringe, *l. c.* 213, t. 18) a variety of the White Mulberry-tree which he had found in the Philippine Islands, where it had been carried by a Portuguese priest toward the end of the sixteenth century. The rapid growth of this tree, its large and succulent leaves, and the ease with which it could be multiplied, soon attracted the attention of European sericulturists ; and in 1827 it was introduced into the United States through the Prince Nursery on Long Island. A year later it was carried to Massachusetts by William Kendrick, a nurseryman of Newton, and gradually marvelous stories of its value spread from town to town and from state to state. Nurserymen gave up all other business to propagate the South Sea novelty ; farmers covered their land with the trees, and all eastern America, converted into one great Mulberry plantation, was to become the rival of the Orient and of Europe in the production of silk. Plants brought fabulous prices, and the north, the south, and the west struggled with each other to secure them in the auction rooms of eastern cities. But the reaction soon came ; the climate of the northern states was found to be too severe for this variety, and trees were killed by cold or by the diseases which appeared among them ; and nurserymen and farmers were ruined. In 1839 the bubble burst ; and of the millions that were planted hardly one tree now remains in any of the northern states. (See Kendrick, *American Silk Growers' Guide*, 26. — L. H. Bailey, *Bull. Hort. Div. Cornell Agric. Exper. Stat.* No. 46 ; also numerous articles in the *New England Farmer*, ix.–xviii.)

The so-called Russian Mulberry (*Morus alba Tatarica*, Loudon) was introduced by Russian Mennonites into the western states in 1875 ; although of comparatively little value as a fruit-tree, it is very hardy, and useful in forming wind-breaks on the prairies or as an ornamental hedge-plant, and several varieties, valued for their large fruit or pendulous branches, have been raised in this

in many varieties[1] for its leaves, which are the best food of the silk-worm. *Morus nigra*,[2] valued in many temperate regions as a fruit-tree, is believed to have originated in Persia; in the temperate and semitropical mountainous regions of India two or three species are recognized;[3] two or three little known and doubtful species inhabit the mountains of the Indian Archipelago,[4] and one and perhaps two others those of central and western South America.[5]

Morus produces straight-grained durable handsome light brown or orange-colored wood sometimes used for furniture, agricultural implements, and fencing, and in boat-building. The fruit of Morus is sweet and acidulous, and possesses slightly laxative properties; syrups made from it are used to flavor or color medicines, or in the preparation of refrigerant beverages.[6] Vinegar is occasionally made from the fruit, from which a mild spirit is sometimes distilled.[7]

The North American species of Morus are not seriously injured by insects[8] or by the ravages of fungal diseases.[9]

country (L. H. Bailey, *Bull. Hort. Div. Cornell Agric. Exper. Stat.* No. 46, 232).

From the leaves of *Morus alba* a yellow dye is obtained in the Caucasus, used in coloring wool and silk; the Vine is tied with its inner bark and staked with its branches; and in Turkestan flour made from the fruit, which is both white and black, support the mountain tribes in winter (*The Industries of Russia*, iii. 436, 462).

The wood of *Morus alba* is moderately hard, light yellow, brown, or yellow. In northern India it is employed in boat-building and for furniture and agricultural implements. The tough branchlets are used as cords, and the leaves are fed to sheep and goats (Brandis, *Forest Fl. Brit. India*, 408); and in China the bark of the roots is administered in the treatment of many human maladies (Smith, *Chinese Mat. Med.* 151).

[1] Loudon, *Arb. Brit.* iii. 1348. — Seringe, *Descr. et Cult. Mur.* 198. — Bureau, *De Candolle Prodr.* xvii. 238. — Rein, *Industries of Japan*, 191.

[2] Linnæus, *Spec.* 986 (1753). — Woodville, *Med. Bot.* ii. 352, t. 129. — *Nouveau Duhamel*, iv. 90, t. 22. — Watson, *Dendr. Brit.* ii. 159, t. 159. — Hayne, *Arzn.* xiii. t. 16. — Reichenbach, *Icon. Fl. Germ.* xii. t. 1328. — Seringe, *l. c.* 220, Atlas, t. 6, f. 4, t. 19. — Parlatore, *Fl. Ital.* iv. 362. — Bureau, *l. c.* — Boissier, *Fl. Orient.* iv. 1153.

The Black Mulberry is believed by A. De Candolle (*Origine des Plantes Cultivées*, 121) to have originated in the country south of the Caucasus and the Caspian Sea; it was well known to the Greeks, who introduced it into Europe, where it now sometimes grows spontaneously in the countries bordering the Mediterranean. Before the greater value of the leaves of *Morus alba* for feeding silk-worms was known to Europeans, they planted the Black Mulberry for this purpose; and in Greece it is still the more commonly used species (Heldreich, *Nutz. Pflanzen*, 19). The Black Mulberry, which is not hardy in the northern United States, is occasionally planted in the southern and Pacific states, although its value as a fruit-tree is not appreciated in this country. The fruit is larger than that of the other species of Morus, and possesses a better flavor; still occasionally used for desserts, it is now in most civilized countries more valued as a palatable and wholesome food for poultry or as an ingredient for cooling beverages.

[3] Of the Indian species of Morus, *Morus Indica* (Linnæus *l. c.*), a shrub or small tree of the temperate and subtropical Himalayas, from Cashmere to Sikkim, is the Mulberry usually planted in Bengal, Burmah, and the Malay Peninsula, to supply food for the silk-worm (Brandis, *l. c.* 409). By some authors it is considered a variety of the Chinese *Morus alba*, while others still regard it as specifically distinct from that plant (Hooker f. *Fl. Brit. Ind.* v. 492).

Morus serrata (Roxburgh, *Fl. Ind.* ed. 2, iii. 596) is an inhabitant of the northwestern Himalayas, where it sometimes ascends to elevations of nine thousand feet above the level of the sea, and is a tree sixty or seventy feet in height, with a stout trunk. It is cultivated in Kunawar; the wood is employed for agricultural implements and many household articles, and the branches are used for fodder (Brandis, *l. c.*).

Morus lævigata (Brandis, *l. c.*) inhabits the evergreen forests of the lower Himalayas from the valley of the Indus to Assam, and is occasionally cultivated.

[4] Miquel, *Fl. Jungh.* 42; *Fl. Ned. Ind.* i. pt. ii. 280; Suppl. 414. — Bureau, *l. c.* 247.

[5] Bureau, *l. c.* 246, 247.

[6] Porcher, *Resources of Southern Fields and Forests*, 305. — Flückiger & Hanbury, *Pharmacographia*, 489. — Johnson, *Man. Med. Bot. N. A.* 244. — *U. S. Dispens.* ed. 16, 986.

[7] *The Industries of Russia*, iii. 436. — Corcoran, *Gard. Chron.* ser. 3, xv. 398.

[8] Few species of insects feed upon the American Mulberry-trees, and even the silk-worms refuse to eat or thrive on *Morus rubra* (Riley, *Special Rep. Dept. Agric.* No. 11, ed. 2, 34; *Bull.* No. 9, ed. 6, *Div. Entomology U. S. Dept. Agric.* 1886, 56). The Fall Web-worm, *Hyphantria cunea*, Drury, is often abundant on *Morus rubra*, and the larvæ of other insects are occasionally sufficiently abundant on the foliage to attract attention. No borers are recorded as affecting the living wood.

[9] The fungal parasites of the Mulberry have been carefully studied in Italy, where this tree is of great economical importance. In his classic work on the subject, *Fungi Moricolæ*, published in Padua in 1889, Berlese has described all the species of fungi known to infest the Mulberry up to that date, and has given figures illustrating most of them. A considerable number of the species are known in this country, and some of them are peculiar to North America. The greater part, however, are species which grow on the trunks, especially the dead trunks, and are not the cause of special diseases, nor are they confined to species of Mulberry. A leaf-mildew, *Uncinula geniculata*, Gerard, has been observed on *Morus rubra* in New York, but not elsewhere, although it probably occurs in other places. *Massaria epileuca*, Berkeley & Curtis, which causes black pustules on the branches, also occurs on *Morus rubra*, and is not known on other species. The leaves of Mulberries are attacked by several spot diseases. *Cercospora Moricola*, Cooke, is recorded on both *Morus alba* and *Morus rubra*. *Phleospora Mori*, Saccardo, a fungus producing brownish spots on the leaves, has been known to cause much trouble in Italy, and is occasionally seen in this country.

Mulberry-trees can be easily raised from seeds which germinate during the spring, and the varieties can be increased by cuttings made from the mature wood or from the roots, by root and crown-grafting, and by budding in early spring with dormant buds.

Morus, the classical name of the Mulberry-tree, was adopted for this genus by Tournefort,[1] and afterward by Linnæus.

[1] *Inst.* 589, t. 362.

SYNOPSIS OF THE NORTH AMERICAN SPECIES.

Leaves ovate, smooth or scabrate on the upper, coated with pale pubescence on the lower surface; fruit oblong, dark purple . . . . . 1. MORUS RUBRA.

Leaves ovate, smooth or scabrate on the upper, glabrous or pubescent on the lower surface; fruit subglobose or short-ovate, nearly black . . . . . 2. MORUS CELTIDIFOLIA.

MORUS RUBRA.

Red Mulberry.

LEAVES ovate, smooth or scabrate on the upper, coated with pale pubescence on the lower surface. Fruit oblong, dark purple.

Morus rubra, Linnæus, *Spec.* 986 (1753). — Miller, *Dict.* ed. 8, No. 3. — Kalm, *Travels*, English ed. iii. 64. — Du Roi, *Obs.* 32; *Harbk. Baumz.* i. 430. — Wangenheim, *Beschreib. Nordam. Holz.* 95; *Nordam. Holz.* 37, t. 15, f. 35. — Moench, *Bäume Weiss.* 63; *Meth.* 343. — Marshall, *Arbust. Am.* 93. — Walter, *Fl. Car.* 241. — Willdenow, *Berl. Baumz.* 197; *Spec.* iv. pt. i. 369; *Enum.* 967. — Poiret, *Lam. Dict.* iv. 377. — Abbot, *Insects of Georgia*, ii. t. 70. — Castiglioni, *Viag. negli Stati Uniti*, ii. 301. — Borkhausen, *Handb. Forstbot.* i. 637. — Michaux, *Fl. Bor.-Am.* ii. 179. — *Nouveau Duhamel*, iv. 91, t. 23. — Persoon, *Syn.* ii. 558. — Desfontaines, *Hist. Arb.* ii. 416. — Du Mont de Courset, *Bot. Cult.* ed. 2, vi. 364. — Michaux f. *Hist. Arb. Am.* iii. 232, t. 10. — Pursh, *Fl. Am. Sept.* ii. 639. — Nuttall, *Gen.* ii. 209. — Hayne, *Dendr. Fl.* 155. — Elliott, *Sk.* ii. 574. — Sprengel, *Syst.* i. 492. — Jaume St. Hilaire, *Traité des Arbres*, t. 46. — Rafinesque, *Am. Man. Mulberry Trees*, 27. — Dietrich, *Syn.* i. 551. — Spach, *Hist. Vég.* xi. 48. — Moretti, *Prodr. Monog. Morus*, 20. — Emerson, *Trees Mass.* 280. — Darlington, *Fl. Cestr.* ed. 3, 285. — Seringe, *Descr. et Cult. Mur.* 223, Atlas, t. 20. — Curtis, *Rep. Geolog. Surv. N. Car.* 1860, iii. 71. — Chapman, *Fl.* 415. — Koch, *Dendr.* ii. 447. — Bureau, *De Candolle Prodr.* xvii. 245. — Ridgway, *Proc. U. S. Nat. Mus.* 1882, 73. — Lauche, *Deutsche Dendr.* 343. — Sargent, *Forest Trees N. Am.* 10*th Census U. S.* ix. 127; *Garden and Forest*, ii. 448. — Watson & Coulter, *Gray's Man.* ed. 6, 464. — Dippel, *Handb. Laubholzk.* ii. 14, f. 5. — Koehne, *Deutsche Dendr.* 139. — Coulter, *Contrib. U. S. Nat. Herb.* ii. 408 (*Man. Pl. W. Texas*).

Morus Canadensis, Poiret, *Lam. Dict.* iv. 380 (1797). — Seringe, *Descr. et Cult. Mur.* 224. — Rafinesque, *New Fl.* iii. 47 (1836); *Am. Man. Mulberry Trees*, 29.

Morus scabra, Willdenow, *Enum.* 967 (1809); *Berl. Baumz.* ed. 2, 252. — Nuttall, *Gen.* ii. 209. — Rafinesque, *New Fl.* iii. 47 (1836); *Am. Man. Mulberry Trees*, 29. — Hayne, *Dendr. Fl.* 154. — Sprengel, *Syst.* i. 492.

Morus tomentosa, Rafinesque, *Fl. Ludovic.* 113 (1817); *New Fl.* 47; *Am. Man. Mulberry Trees*, 30.

Morus rubra, var. **pallida**, Rafinesque, *New Fl.* iii. 46 (1836); *Am. Man. Mulberry Trees*, 28.

Morus rubra, var. **heterophylla**, Rafinesque, *New Fl.* iii. 46 (1836); *Am. Man. Mulberry Trees*, 28.

Morus riparia, Rafinesque, *New Fl.* iii. 46 (1836); *Am. Man. Mulberry Trees*, 31.

Morus rubra, var. **purpurea**, Rafinesque, *Am. Man. Mulberry Trees*, 28 (1839).

Morus reticulata, Rafinesque, *Am. Man. Mulberry Trees*, 28 (1839).

Morus rubra, var. **tomentosa**, Bureau, *De Candolle Prodr.* xvii. 246 (1873).

Morus rubra, var. **incisa**, De Candolle, *Prodr.* xvii. 247 (1873).

A tree, sixty to seventy feet in height, with a short trunk rarely exceeding three or four feet in diameter, and stout spreading smooth branches which form a dense broad round-topped shapely head.[1] The bark of the trunk, which is one half to three quarters of an inch in thickness, is dark brown tinged with red, and divided into irregular elongated plates separating on the surface into thick appressed scales. The branchlets are slender and slightly zigzag, and, when they first appear, are dark green often tinged with red, glabrous, or more or less coated with pale pubescence, and covered with oblong straw-colored spots; in their first winter they are light red-brown to orange-color and marked by pale lenticels and large elevated horizontal nearly orbicular concave leaf-scars, in which a row of prominent fibro-vascular bundle-scars appears; in their second or third year they turn dark brown faintly tinged with red. The buds are ovate, rounded or pointed at the apex, covered by six or seven chestnut-brown scales, and a quarter of an inch in length; the scales of the two or three outer rows are broadly ovate, rounded and slightly thickened on the back, puberulous, ciliate on the margins with short pale hairs, and much shorter than those of the next rows; these are ovate-oblong, thick and rounded on the back,

[1] The largest trunk of *Morus rubra* I have seen was that of a venerable tree growing on the estate of Mr. P. J. Berckmans in Augusta, Georgia, which in 1880 had a diameter of seven feet one inch, three feet above the surface of the ground.

and very lustrous, inclosing the inner scales, which are scarious, coated with pale hairs, oblong-lanceolate, rounded or acute at the apex, and one half to two thirds of an inch long at maturity. The leaves are ovate, oblong-ovate, or semiorbicular, abruptly contracted into long broad points or acute at the apex, more or less deeply cordate or occasionally truncate at the base, coarsely and occasionally doubly serrate with incurved teeth ending in minute callous tips, and sometimes, especially on vigorous young shoots, three-lobed by broad deep oblique rounded lateral sinuses, entire in the bottom, the lower lobes being again sometimes slightly lobed; when they unfold they are yellow-green, slightly pilose on the upper surface, and coated on the lower surface and on the petioles with thick white tomentum, which soon begins to disappear, and at maturity they are thin and membranaceous, dark bluish green, glabrous, smooth or scabrate above, and pale and more or less pubescent below with short white hairs, which are thickest on the narrow orange-colored ribs and primary veins arcuate and united near the margins, and connected by reticulate veinlets, or sometimes in Louisiana and Texas the lower surface is covered with a thick coat of white tomentum; they are three to five inches long, two and one half to four inches broad, and are borne on stout terete petioles three quarters of an inch to an inch and one quarter in length. The stipules are lanceolate, acute, abruptly enlarged and thickened at the base, sometimes tinged with red above the middle, coated with long white hairs, and often an inch long. The leaves turn bright yellow, and fall early in the autumn. The flowers appear with the unfolding of the leaves from the middle of March in Texas to the middle of June in western New York; the males are borne in narrow spikes two to two and a half inches long on stout light green peduncles covered with pale hairs, and produced in the axils of the inner bud-scales or of the first leaves, and the females, with which a few male flowers are sometimes mixed, in oblong densely flowered spikes an inch long on short hairy peduncles in the axils of later leaves. The bud of the staminate flower is conspicuously four-lobed, depressed at the apex, green below and dark red above the middle, covered with pale hairs, and gradually narrowed into a short hairy pedicel; after anthesis the calyx is divided nearly to the base into four oblong concave lobes rounded at the apex, slightly thickened on the back, and hirsute on the outer surface. The filaments are inserted under the margin of the slender minute pointed rudimentary ovary, and are slightly flattened, narrowed from the base to the apex, abruptly infolded above the middle in the bud and exserted after anthesis; the anthers are bright green, with conspicuous bright green orbicular connectives. The bud of the pistillate flower is obovate, four-lobed, pilose, slightly depressed and hirsute at the apex, bright green below and dark red above the middle, and sessile on the stout hairy rachis; after anthesis the calyx is divided nearly to the base into four thick concave lobes, rounded at the apex, and rounded or slightly angled on the back, the two outer lobes being nearly twice as wide as the others; it is as long as the ovary, which it closely invests, and which is ovate, flattened, glabrous, light green and lustrous, and crowned with a short style, divided into two long white stigmatic lobes. The compound fruit, which at first is bright red when it is fully grown, ripens from May to July; it is an inch to an inch and a quarter long, dark purple or nearly black, and sweet and juicy when fully ripe; the drupes are about one thirty-second of an inch in length, with a thin fleshy outer coat and a light brown nutlet. The seed is ovate, acute, and covered with a thin membranaceous light brown coat.

Morus rubra is distributed from western Massachusetts and Long Island, New York, to southern Ontario[1] and central Michigan, westward to southeastern Nebraska[2] and eastern Kansas, and southward to the shores of Bay Biscayne and Cape Romano in Florida and the valley of the Colorado River in Texas. An inhabitant of the rich soil of intervale lands and low hills, *Morus rubra* is most abundant, and attains its largest size in the basin of the lower Ohio River and on the foothills of the southern Appalachian Mountains.

The wood of *Morus rubra* is light, soft, not strong, rather tough, coarse-grained, and very durable when placed in contact with the soil; it contains may thin medullary rays and broad bands of large

[1] Macoun, *Cat. Can. Pl.* i. 430.

[2] Bessey, *Rep. Nebraska State Board Agric.* 1894, 105.

open ducts marking the layers of annual growth, and is light orange-color, with thick lighter colored nearly white sapwood. The specific gravity of the absolutely dry wood is 0.5898, a cubic foot weighing 36.75 pounds. Its durability makes it valuable for fencing, for which it is largely used, as well as in cooperage, and in the southern states it is often employed in ship and boat building. From the inner bark the Indians of the southern states obtained a fibre with which they wove coarse cloth.[1]

Morus rubra was introduced into English gardens early in the seventeenth century,[2] and was first described from a cultivated plant in Parkinson's *Paradisi in sole Paradisus Terrestris*,[3] published in London in 1629, although the efforts of the Crown to establish sericulture in North America had much earlier drawn the attention of travelers in the colonies to the native Mulberry-tree, which is often mentioned in their narratives.[4]

The Red Mulberry is occasionally planted in orchards in the southern states for the sake of its fruit, which is considered valuable for fattening hogs and as food for poultry; but, as a fruit-tree, it has been generally neglected by horticulturists who have, however, multiplied two or three natural varieties distinguished for the large size and good quality of their fruits or for their productiveness.[5]

The size of the Red Mulberry, surpassing as it does in height and beauty all Mulberry-trees of temperate regions, the dense shade afforded by its broad compact crown of dark blue-green leaves, its freedom from disease and the attacks of disfiguring insects, its prolificness, its hardiness except in its earliest years, and the rapidity of its growth in good soil, make it a most desirable ornamental tree.

[1] "A fourth chiefe commoditie wee may account to be the great number of Mulberrie trees, apt to feede Silke-worms to make silke: whereof there was such plentie in many places, that, though they found some hempe in the countrie, the Spaniards made ropes of the barks of them for their brigandines, when they were to sut to see for Noua Hispania." (*Virginia richly valued.* Written by a Portugall gentleman of *Eluas*, emploied in all the action, and translated out of Portuguese, by Richard Hakluyt, Epistle Dedicatore, p. 3 [Force, *Coll. Hist. Tracts*, iv. No. 1].)

"This tree (the Mulberry) is found in abundance in the North Western parts of Florida: the chactaws put its inner bark in hot water along with a quantity of ashes and obtain filaments, with which they weave a kind of cloth not unlike a coarse hempen cloth." (Romans, *Nat. Hist. Florida*, 142. See, also, Le Page du Pratz, *Histoire de la Louisiane*, ii. 192.)

[2] Aiton, *Hort. Kew.* iii. 343. — Loudon, *Arb. Brit.* iii. 1359, t.

[3] *Morus Virginiana*, 599, f. 4; *Theatr.* 1492.

Corylus maxima folio latissimo Virginiana, Ray, *Hist. Pl.* ii. 1799.

Morifolia Virginiensis arbor, Loti arboris instar ramosa, foliis amplissimis, Plukenet, *Phyt.* t. 246, f. 4; *Alm. Bot.* 253. — Miller, *Dict.* No. 6.

Morus Virginiana, foliis latissimis scabris, fructu rubro longiori, Miller, *Dict.* No. 5.

Morus foliis amplissimis Fici similibus, fructeo longo nigro purpureo, Clayton, *Fl. Virgin.* 122.

[4] William Strachey, who visited the colony on the James River in Virginia in 1610, found by the houses of the settlers "some great mulberrye trees, and these in some parts of the country are found growing naturally in pretty groves: there was an assay made to make silke, and surely the wormes prospered excellently well until the master workman fell sick, during which tyme they were eaten with ratts, and this wilbe a commoditie not meanely profitable." (*The History of Travaile into Virginia Britannia*, ed. Major, 117.)

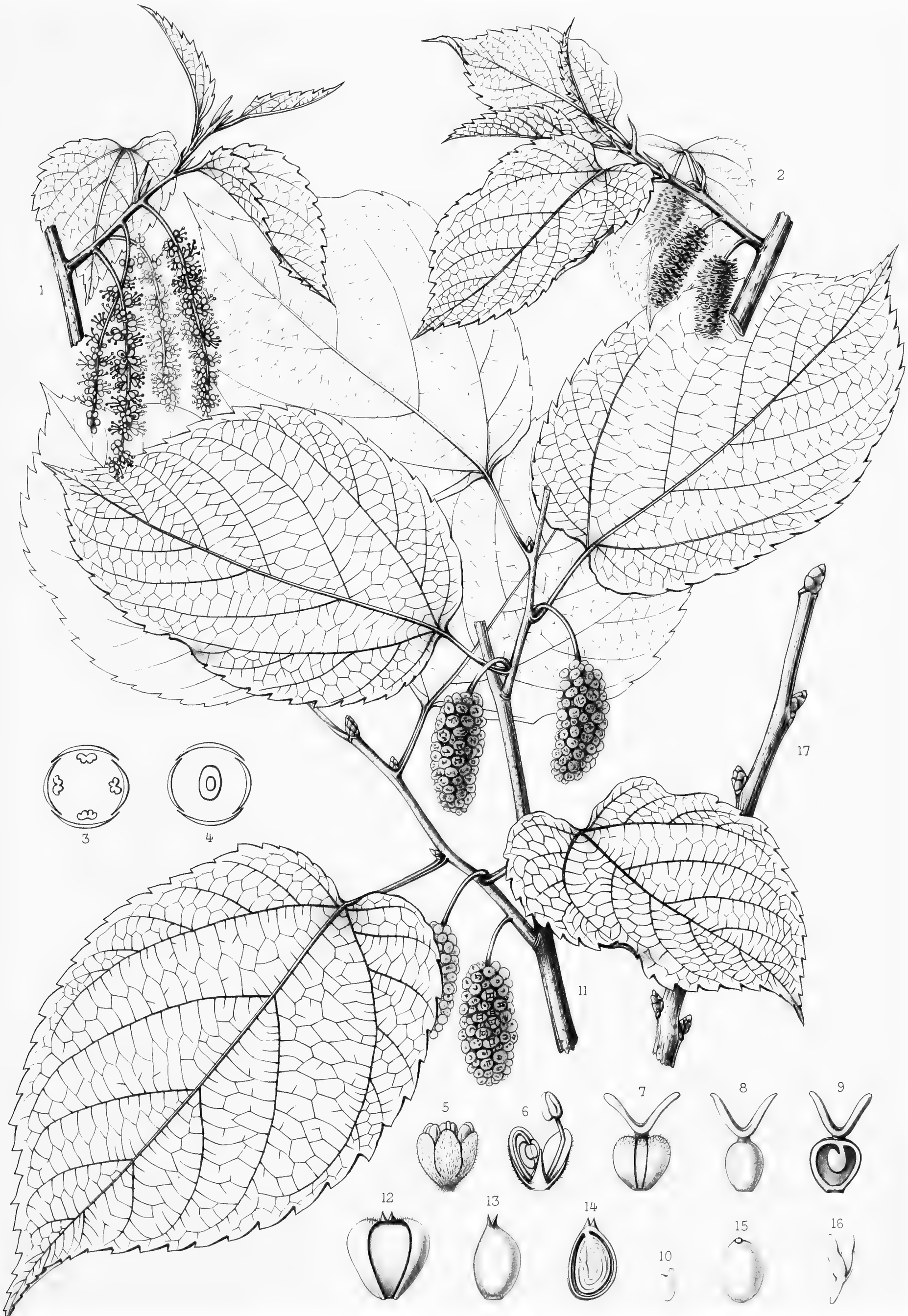
See, also, *Nova Britannia: Offering most excellent fruites for Planting in Virginia.* London, 1609, p. 16 (Force, *l. c.* i. No. 6); *A Perfect Description of Virginia*, London, 1649, in which among the natural products of the Colony are mentioned "Mulbery-trees, the natural and proper food for *Silke-wormes*, they have abundance in the woods, and some so large that one tree contains as many leaves as will feed *Silke-wormes* that will make as much Silk as may be worth five pounds *sterling* money, this some *French* men affirm," p. 6 (Force, *l. c.* ii. No. 8); and *Virginia: more especially the South part thereof, Richly and truly valued*, ed. 2, by E. W. Gent, London, 1650 (Force, *l. c.* iii. No. 11).

[5] L. H. Bailey, *Bull. Hort. Div. Cornell Agric. Exper. Stat.* No. 10, 238.

EXPLANATION OF THE PLATE.

Plate CCCXX. Morus rubra.

1. A flowering branch with staminate flowers, natural size.
2. A flowering branch with pistillate flowers, natural size.
3. Diagram of a staminate flower.
4. Diagram of a pistillate flower.
5. A staminate flower before the exsertion of the stamens, enlarged.
6. Vertical section of a staminate flower with one stamen partly exserted, enlarged.
7. A pistillate flower, enlarged.
8. A pistil, enlarged.
9. Vertical section of a pistil, enlarged.
10. An ovule, much magnified.
11. A fruiting branch, natural size.
12. A fruit inclosed in the fleshy calyx, enlarged.
13. A nutlet, enlarged.
14. Vertical section of a nutlet, enlarged.
15. A seed, enlarged.
16. An embryo, much magnified.
17. A winter branchlet, natural size.



C.E. Faxon del. Toulet sc.

MORUS RUBRA, L

A. Riocreux direx.t Imp. J. Taneur, Paris.

MORUS CELTIDIFOLIA.

Mulberry. Mexican Mulberry.

LEAVES ovate, smooth or scabrous on the upper, glabrous or pubescent on the lower surface. Fruit subglobose or short-ovate, nearly black.

Morus celtidifolia, Humboldt, Bonpland & Kunth, *Nov. Gen. et Spec.* ii. 33 (1817). — Kunth, *Syn. Pl. Æquin.* i. 370. — Rafinesque, *Am. Man. Mulberry Trees*, 32. — Dietrich, *Syn.* i. 551. — Bureau, *De Candolle Prodr.* xvii. 246. — Hemsley, *Bot. Biol. Am. Cent.* iii. 141. — Sargent, *Garden and Forest*, ii. 448.

Morus Mexicana, Bentham, *Pl. Hartweg.* 71 (1839). — Liebmann, *Dansk. Vidensk. Selsk. Skrift.* ser. 5, ii. 314.

Morus microphylla, Buckley, *Proc. Phil. Acad.* 1862, 8. — Gray, *Proc. Phil. Acad.* 1862, 167. — Sargent, *Forest Trees N. Am. 10th Census U. S.* ix. 128. — Coulter, *Contrib. U. S. Nat. Herb.* ii. 408 (*Man. Pl. W. Texas*).

A tree, sometimes thirty feet in height in the United States, with a trunk occasionally twelve to fourteen inches in diameter, or usually much smaller, and often reduced to a low shrub; or in northern Mexico frequently much larger. The bark of the trunk is smooth, sometimes nearly half an inch thick, although usually thinner, light gray, slightly tinged with red, deeply furrowed and broken on the surface into small appressed scales. The branchlets, when they first appear, are covered with soft white hairs; they soon become glabrous or nearly so, and during their first winter are light orange-red marked with small lenticels, and with small horizontal nearly orbicular elevated concave leaf-scars in which appears a ring of fibro-vascular bundle-scars. The buds are ovate, acute, sharp-pointed, and covered with thin lustrous chestnut-brown ovate rounded scales, scarious on the margins; those of the inner rows are accrescent, ovate-oblong, rounded at the apex, coated on the outer surface with pale pubescence, and nearly an inch long when fully grown. The leaves are ovate, acute or acuminate at the apex, rounded or rarely truncate at the broad base, and coarsely and sharply serrate, or often, especially on vigorous shoots, they are three-lobed with shallow lateral sinuses and broad coarsely serrate lobes, and are then frequently cordate at the base; when they unfold they are coated below and on the petioles with pale tomentum, and are puberulous above; and at maturity they are thin and firm in texture, dark green and often roughened on the upper surface with minute pale tubercles, and paler, smooth or scabrate on the lower surface, which is glabrous or coated with soft pale pubescence, and often hirsute with short stiff pale hairs on the broad orange-colored ribs and on the primary veins, which are arcuate and united near the margins, and connected by conspicuous reticulate veinlets; on wild trees in the United States they are rarely more than an inch and a half in length and three quarters of an inch to an inch in width, and are borne on slender pubescent petioles, one third of an inch long; on trees cultivated in northern Mexico the leaves are thinner, smoother, and often four or five inches long, and two to three inches wide. The stipules are linear-lanceolate, acute, sometimes falcate, white and scarious, coated with soft pale tomentum, and about half an inch in length. The leaves turn yellow in the autumn before falling. The flowers open from March in the Texas lowlands to April and May on the mountains of Chihuahua and New Mexico; they are usually dicœcious, and are borne on slender hairy peduncles produced in the axils of the caducous bud-scales or of the first leaves, the males being short-pedicellate in short many-flowered spikes one half to three quarters of an inch long, and the females sessile in few-flowered spikes, which rarely exceed one third of an inch in length. The calyx of the staminate flower is dark green, covered on the outer surface with soft pale hairs, and deeply divided into four equal rounded lobes, reddish toward the apex. The stamens are inserted under the margin of the minute rudimentary ovary, and are composed of slender slightly flattened bright yellow anthers, with conspicuous darker green connectives. The calyx of the pistillate flower is

divided to the base into four thick rounded lobes, the two outer lobes being much broader than the others, and is dark green, and covered with pale scattered hairs, which are most abundant on the margins of the lobes. The ovary is flattened, green and glabrous, and is surmounted by a short style, divided into two short white stigmatic branches. The fruit, which ripens from May to July, and is sparingly produced on wild trees, is half an inch long, dark purple or nearly black, and sweet and palatable. The drupe is two lines long, ovate, rounded at both ends, with a thin fleshy outer covering and a thick-walled light brown nutlet. The seed is ovate, pointed, and covered with a membranaceous pale yellow testa.

In the United States *Morus celtidifolia* is distributed from the valley of the Colorado River southward in Texas, and through the mountain regions of western Texas and southern New Mexico to the Santa Rita Mountains of Arizona; in the east it grows on dry limestone hills, where it usually appears as a low shrub, or on the banks of streams, where it is associated with the Black Walnut, the Ash-leaved Maple, the Spanish Buckeye, and the Texas Oak, often developing into a shapely tree; farther west it is found only in elevated mountain cañons in the neighborhood of streams. It is common on the mountain ranges of northern Mexico from Nuevo Leon to Chihuahua, and ranges southward through southern Mexico and Central America to Peru.

The wood of *Morus celtidifolia* is heavy, hard, close-grained, and contains numerous thin medullary rays and bands of small open ducts marking the layers of annual growth; it is dark orange-color or sometimes dark brown, with thick light yellow sapwood. The specific gravity of the absolutely dry wood is 0.7715, a cubic foot weighing 48.08 pounds. It was formerly used for bows by the Indians of western Texas.[1]

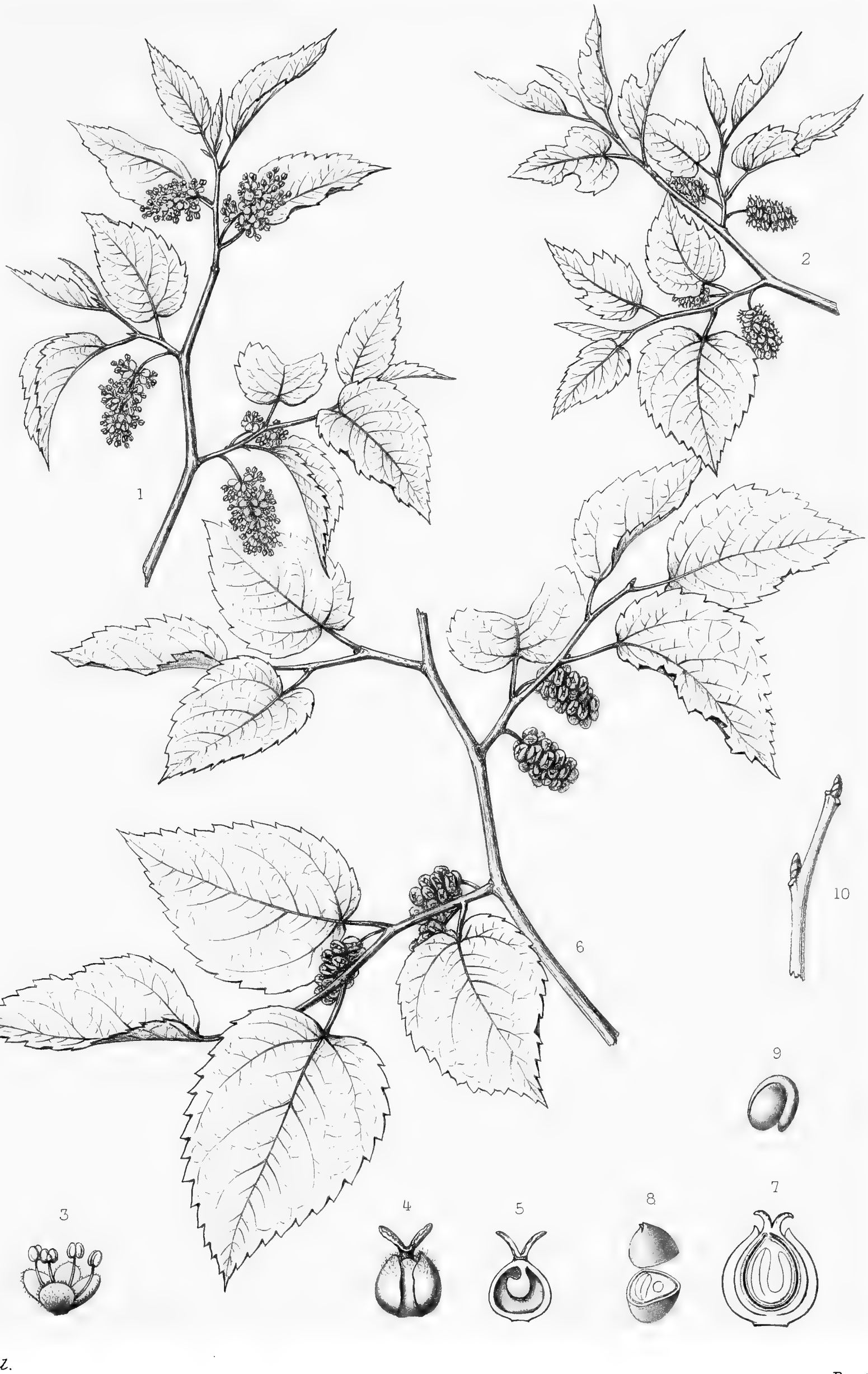
Discovered by Humboldt among the Andes of Ecuador, *Morus celtidifolia* was first noticed in Texas in the neighborhood of the German colony of New Braunfels by Ferdinand Lindheimer.[2] In the countries south of the United States it is frequently planted as a fruit-tree,[3] although the fruit which it produces is inferior in size and flavor to that of the Red and Black Mulberry-trees.

[1] Havard, *Proc. U. S. Nat. Mus.* viii. 507.
[2] See i. 74.
[3] Kunth, *Syn. Pl. Æquin.* i. 370.

EXPLANATION OF THE PLATE.

PLATE CCCXXI. MORUS CELTIDIFOLIA.

1. A branch with staminate flowers, natural size.
2. A branch with pistillate flowers, natural size.
3. A staminate flower, enlarged.
4. A pistillate flower, enlarged.
5. Vertical section of a pistil, enlarged.
6. A fruiting branch, natural size.
7. Vertical section of a fruit, enlarged.
8. A nutlet cut open transversely, enlarged.
9. An embryo, enlarged.
10. A winter branchlet, natural size.



C.E.Faxon del.

Rapine sc.

MORUS CELTIDIFOLIA, H.BK.

A.Riocreux direx.t

Imp. J. Taneur, Paris.

TOXYLON.

FLOWERS diœcious; calyx 4-lobed, the lobes imbricated in æstivation; corolla 0; stamens 4, incurved before anthesis; disk pulvinate, minute; ovary superior, 1-celled; ovule solitary, suspended. Fruits drupaceous, united into a globose syncarp. Leaves alternate, entire, stipulate, deciduous.

Toxylon (**Ioxylon**), Rafinesque, *Am. Monthl. Mag. and Crit. Rev.* ii. 118 (1817); *New Fl.* iii. 42.
Maclura, Nuttall, *Gen.* ii. 233 (1818). — Endlicher, *Gen.* 278. — Meisner, *Gen.* 351. — Baillon, *Hist. Pl.* vi. 193. — Bentham & Hooker, *Gen.* iii. 363. — Engler, *Engler & Prantl Pflanzenfam.* iii. pt. i. 174.

A tree, with thick milky slightly acrid juice, thick deeply furrowed dark orange-colored bark, stout tough terete flexible pale branches, with thick orange-colored pith, marked with raised orange-colored lenticels, often armed with stout straight axillary spines, short stout spur-like branchlets developed from lateral buds at the base of the spines, and thick fleshy flexible roots covered with bright orange-colored bark exfoliating freely in long thin papery persistent scales. Buds[1] formed in summer, depressed-globose, partly immersed in the bark, covered with a few closely imbricated ovate rounded light chestnut-brown caducous scales, ciliate on the margins. Leaves involute in vernation, ovate to oblong-lanceolate, acuminate and apiculate at the apex, rounded, wedge-shaped or subcordate at the base, entire, penniveined, the veins arcuate and united near the margins and connected by inconspicuous reticulate veinlets, petiolate with elongated slender terete pubescent petioles obscurely grooved on the upper side, at first pubescent on the upper surface, and coated on the lower with soft white tomentum, at maturity glabrous, or pubescent on the under surface of the prominent midribs and veins, thick and firm, dark green and very lustrous above, paler and dull below, deciduous, marking the branchlets in falling with large pale elevated concave leaf-scars displaying a central ring of small fibro-vascular bundle scars; stipules lateral, nearly triangular, minute, coated with pale tomentum, caducous. Flowers light green, minute, appearing in early summer, the staminate long-pedicellate in short or ultimately elongated racemes borne on long slender drooping peduncles developed from the axils of crowded leaves on the spur-like branchlets of the previous year, the pistillate sessile in dense globose many-flowered heads on short stout peduncles axillary on shoots of the year. Calyx of the staminate flower ovate, gradually narrowed into the slender pubescent pedicel, coated on the outer surface with pale hairs, divided to the middle into four equal acute boat-shaped lobes. Stamens four, inserted opposite the lobes of the calyx on the margin of a minute thin pulvinate disk; wanting in the pistillate flower; filaments flattened, light green, glabrous, infolded above the middle in the bud, with the anthers inverted and back to back, straightening abruptly in anthesis, exserted; anthers oblong, attached on the back near the middle, introrse, two-celled, the cells attached laterally to a minute oblong or semiorbicular connective, free and spreading above and below, opening by longitudinal lateral slits. Calyx of the pistillate flower ovate, divided to the base into four oblong thick concave lobes, rounded, thickened and covered with pale hairs at the apex, longer than the ovary and closely investing it, the two outer lobes much broader than the others, accrescent, persistent, and inclosing the fruit. Ovary ovate, compressed, sessile, green and glabrous, crowned by a long slender filiform style covered with white stigmatic hairs; wanting in

[1] Toxylon does not form a terminal bud, the end of the branch withering and falling off before midsummer; the following spring it is prolonged by an upper axillary bud or often by an axillary bud on one of the last lateral spur-like branchlets, the base of the branch then remaining rough and thickened during several years by the persistent crowded scars left by the leaves of the branchlet. (Foerste, *Bull. Torrey Bot. Club*, xx. 163, t. 147, f. 1.)

the staminate flower; ovule solitary, suspended from the apex of the cell, anatropous. Fruit drupaceous, oblong, compressed, rounded and often notched at the apex, acute at the base; epicarp thin and succulent; endocarp thin, crustaceous, light brown. Seed oblong, compressed, rounded at the base, oblique and marked at the apex by the conspicuous oblong pale hilum, destitute of albumen; testa membranaceous, light chestnut-brown. Embryo recurved; cotyledons oblong, nearly equal; radicle elongated, incumbent, ascending. Syncarp formed by the union of the thickened and much elongated stringy tough perianths, globose, saturated with milky juice, mammillate on the surface by their thickened rounded summits, light yellow-green; usually of full size but seedless on isolated pistillate individuals.

The wood of Toxylon is heavy, exceedingly hard, very strong, flexible, coarse-grained, with a satiny surface susceptible of receiving a beautiful polish, and very durable in contact with the ground; it contains numerous thin conspicuous medullary rays, many small open ducts and broad bands of larger ducts marking the layers of annual growth. It is bright orange-colored, turning brown on exposure to the atmosphere, with thin light yellow sapwood composed of five to ten layers of annual growth. The specific gravity of the absolutely dry wood is 0.7736, a cubic foot weighing 48.21 pounds. It is largely used for fence-posts, pavement-blocks, railway ties,[1] and wheel-stock, and as a substitute for Olive wood in the manufacture of many small articles; formerly it was employed by the Osage and other Indians west of the Mississippi River for bows and war-clubs.

The bark of the roots of Toxylon, which contains moric and morintannic acid,[2] has some value as a yellow dye,[3] and that of the trunk is sometimes used in tanning leather.[4]

The earliest account of the Osage Orange appears in the narrative[5] of Dunbar and Hunter's journey made in 1804 from St. Catherine's Landing on the Mississippi to the Washita River. It was first found by Mr. Dunbar[6] at the post of the Washita, although traders with the Indians of the Red River had doubtless been familiar with their Bois d'Arc before this, for in 1810 Bradbury[7] found two trees growing in Pierre Chouteau's[8] garden in St. Louis old enough to bear fruit. In the preface to Pursh's *Flora Americæ Septentrionalis*, published in 1814, allusion is made to its discovery by the expedition which crossed and recrossed the continent in 1804–1806 under command of Captains Lewis and Clark, although there is no mention of the tree in their published journals. Early in this century seeds of the Osage Orange were received in Philadelphia by Bernard MacMahon[9] and David

[1] "In 1873 we procured from Texas some railroad ties of Osage Orange, and had them put in the road-bed of the New York Division of the Pennsylvania Railroad alongside of oak, chestnut, and catalpa. The soft woods were all torn out in two or three years, but the Osage Orange, after twenty-one years, is still in place, after having been turned several times, and still as good as the first year." (Bernet Landreth in litt., July, 1893.)

[2] King, *Am. Jour. Pharm.* xlvi. 275.

[3] Guibourt, *Hist. Drog.* ed. 7, ii. 325. — Baillon, *Hist. Pl.* vi. 179. — *U. S. Dispens.* ed. 16, 1848.

[4] Reverchon, *Garden and Forest*, vi. 524.

[5] *The Message of the President of the United States*, February 19, 1806, communicating discoveries made in exploring the Missouri, Red, and Washita Rivers, 166.

Dunbar praised the appearance of the Osage Orange, which he considered one of the most beautiful trees he had seen, suggested its probable value as a hedge-plant, and alluded to the dye obtained by the Indians from its roots.

[6] William Dunbar (about 1746–1810) was born in Scotland, and educated in Glasgow and London. His proficiency in mathematics and astronomy made him known to Sir William Herschel, with whom he corresponded for many years. In 1771, Dunbar, being out of health, came to Philadelphia in charge of a mercantile venture. He visited Pittsburgh, and then joining a company formed to colonize West Florida, became a planter, settling in Baton Rouge, and afterward in Natchez. He was a friend and correspondent of Jefferson, and received several appointments under the Federal Government. He was a member of the American Philosophical Society, and contributed to its Proceedings papers on ethnology, meteorology, and astronomy.

[7] *Travels in the Interior of North America in the Years 1809, 1810, and 1811*, 159.

Bradbury describes the bows and war-clubs made from the wood of the Osage Orange as well as the two cultivated trees. In Arkansas the price of a bow made of the wood was in his time a horse and blanket.

[8] Pierre Chouteau (1749–1849), a native of New Orleans, was one of the settlers of St. Louis, the site of which he selected with his brother Auguste in 1763. By honesty and intelligence he acquired wealth in trading with the Indians, over whom he had great influence, and lived to see a great city rise on the uninhabited bluff where he had landed as a young man.

[9] Bernard MacMahon (about 1775–1816) was born in Ireland, and was of good birth and fortune. Obliged to leave Ireland owing to his connection with one of the unsuccessful rebellions which distracted it during the last years of the eighteenth century, he

Landreth,[1] who raised plants from them; it was sent to England in 1818,[2] and two years later was cultivated in the nurseries of Jacques Martin Cels[3] in Paris.[4]

Toxylon is remarkably free from the attacks of destructive insects[5] and fungal diseases.[6]

The generic name, first misprinted Ioxylon, from *τόξον* and *ξύλον*, alludes to the Indian use of the wood.[7]

The genus is represented by a single species.

came to the United States in 1796. MacMahon enjoyed the friendship of Jefferson and other distinguished Americans, and it is supposed that the arrangement for the Lewis & Clark Expedition was made at his house in Philadelphia. In 1809 he established a seed and nursery business in his garden, which he supplemented by a seed store on Second Street, near Market. The site of his garden is now occupied by the yards of the Philadelphia & Reading Railroad at Huntington Station in Philadelphia. MacMahon was the author of the *American Gardeners' Calendar*, published in 1806, which subsequently passed through several editions, and is still one of the most comprehensive and useful books of its class that has been written. *Mahonia*, a genus of handsome evergreen shrubs of western North America and eastern Asia, now considered a section of Berberis, was dedicated to him by Thomas Nuttall.

[1] David Landreth (1752–1836) was a native of Brunswick on the Tweed, and the son of a Northumberland farmer. Having learned the art of tree-growing, he emigrated to Canada in 1781, removing shortly afterward to Philadelphia, where, in 1786, in partnership with his brother Cuthbert, he established the nursery and seed business, which is still carried on by his descendants, who have always occupied prominent and honorable positions in the agricultural and horticultural industries of the country. In 1804 or 1805 David Landreth received from the Lewis & Clark Expedition seeds of the Osage Orange, which produced a number of plants. One of these, planted in front of the old Landreth mansion house on the ground now occupied by the Landreth School, at 22d and Federal Streets, Philadelphia, flowered before the others; it was a pistillate tree, and produced no fruit until some years later, when the flowers were artificially impregnated by pollen brought from another tree supposed to have been growing in MacMahon's garden.

[2] Loudon, *Gard. Mag.* i. 356.

[3] See ii. 4.

[4] Delile, *Bull. Soc. d'Agric. Hérault*, 1835, 195.

[5] The larvæ of a large beetle, *Dorchaschema Wildii*, Uhler, sometimes bore into the trunks and injure or destroy Toxylon. Various grasshoppers, crickets, and other insects sometimes eat the leaves, and the larvæ of such small moths as *Teras hastiana*, Linnæus, and *Lophoderus triferanus*, Walker, occasionally injure them. A Pyralid, *Loxostege Macluræ*, Riley (*Insect Life*, v. 155, f. 11), appears to be peculiar to the genus. Scale insects, or Coccids, like *Pulvinaria innumerabilis*, Rathvon, are sometimes found on Toxylon. Silkworms feed and thrive on the leaves (Riley, *Bull. No.* 9, *Division of Entomology, U. S. Dept. Agric.* 58).

[6] The commonest parasite of Toxylon, *Sphæria collecta*, Schweinitz, appears in the form of small black pustules on twigs and smaller branches, which it appears to destroy, although the fungus is best seen on the twigs after they are dead. *Valsa Macluræ*, Berkeley & Curtis, *Collosphæria corticata*, Ellis & Everhart, *Septosphæria Macluræ*, Ellis & Everhart, and *Sphærella Macluræ*, Ellis & Everhart, are small Pyrenomycetes sometimes found on Toxylon; and a rust fungus, *Uredo Citri*, Cooke, has been seen once on its leaves.

[7] Rafinesque, *New Fl.* iii. 42.

TOXYLON POMIFERUM.

Osage Orange. Bow Wood.

Toxylon (Ioxylon) pomiferum, Rafinesque, *Am. Monthl. Mag. and Crit. Rev.* ii. 118 (1817). — Greene, *Pittonia*, ii. 122. — Sudworth, *Rep. Sec. Agric.* 1892, 327. — Koehne, *Deutsche Dendr.* 139. — Coulter, *Contrib. U. S. Nat. Herb.* ii. 408 (*Man. Pl. W. Texas*).

Maclura aurantiaca, Nuttall, *Gen.* ii. 234 (1818); *Jour. Phil. Acad.* vii. pt. i. 52; *Trans. Am. Phil. Soc.* n. ser. v. 169; *Sylva*, i. 126, t. 37, 38. — James, *Long's Exped.* ii. 158. — Soulange-Bodin, *Ann. Soc. Hort. Paris*, i. 181. — Desfontaines, *Cat. Hort. Paris*, ed. 3, 347. — Seringe, *Trans. Soc. d'Agric. Lyons*, 1835, 125, t.; *Descr. et Cult. Mur.* 232, t. 27. — Delile, *Bull. Soc. d'Agric. Hérault*, 1835, 189, t. — Lambert, *Pinus*, ed. 2, ii. Appx. 32, t. 12. — Denson, *London Gard. Mag.* n. ser. i. 312, f. 45–47. — Loudon, *Arb. Brit.* iii. 1362, f. 1226–1228. — Spach, *Hist. Vég.* xi. 53. — Blume, *Mus. Bot. Lugd. Bat.* ii. 82. — Miquel, *Martius Fl. Brasil.* iv. pt. i. 158. — Koch, *Dendr.* ii. 437. — Bureau, *De Candolle Prodr.* xvii. 227. — Lauche, *Deutsche Dendr.* 339, f. 130. — Sargent, *Forest Trees N. Am. 10th Census U. S.* ix. 128. — Watson & Coulter, *Gray's Man.* ed. 6, 464. — Dippel, *Handb. Laubholzk.* ii. 15.

Broussonetia tinctoria, Torrey, *Ann. Lyc. N. Y.* ii. 246 (not Kunth) (1828).

Toxylon aurantiacum, Rafinesque, *Med. Fl.* ii. 268 (1830).

Toxylon Maclura, Rafinesque, *New Fl.* iii. 43 (1836); *Aut. Bot.* 149; *Am. Man. Mulberry Trees*, 13.

A tree, sometimes fifty to sixty feet in height, with a short trunk two to three feet in diameter, and stout erect ultimately spreading branches which form a handsome rather open irregular round-topped head. The bark of the trunk is two thirds of an inch to an inch in thickness, and is deeply and irregularly divided into broad rounded ridges separating on the surface into thin appressed scales. The branchlets, when they first appear, are light green, often tinged with red, and coated with soft pale pubescence, which soon disappears, and during their first winter they are light brown slightly tinged with orange-color, later becoming paler. The leaves are three to five inches long, two to three inches wide, and are borne on petioles an inch and a half to two inches in length; in the autumn they turn a bright clear yellow before falling. The racemes of staminate flowers with their peduncles are an inch to an inch and a half long, and the heads of pistillate flowers are three quarters of an inch in diameter. The fruit, which is four or five inches in diameter, ripens in the autumn, and soon falls to the ground, where it lies under the trees until it rots or is eaten by horses or cattle.

Toxylon pomiferum is distributed from southern Arkansas south of the Arkansas River through the southeastern portions of the Indian Territory, and southward in Texas to about latitude 35° 56″ north. It is an inhabitant of rich bottom-lands, and appears to be most abundant and to attain its greatest size in the valley of the Red River in the Indian Territory.

An inhabitant of a region of comparatively limited area, of high winter and summer temperature and of copious rainfall, the Osage Orange, nevertheless, flourishes on the dry soil of the western prairies and in the severe climate of New England; and during the last forty years it has been more used in the western states for making live fences, or hedges, than any other plant.[1] Its hardiness and rapid growth,[2] the toughness of its well-armed branches, and its freedom from disease and insect enemies, make it valuable for this purpose. The good habit, the large lustrous and abundant leaves, and the beauty of the large fruits which in autumn cover the branches of the pistillate trees, make them desirable ornaments of parks and gardens.

[1] McGraw, *Rep. Commissioner of Patents*, 1854, Agriculture, 418. — S. A. Lindley, *Ibid.* 1855, 315. — Torrey, *Ibid.* 1857, 242. — Warder, *Hedges and Evergreens*, 35, t. 5, 173, 215. — Porcher, *Resources of Southern Fields and Forests*, 101. See also notes on the value of the Osage Orange, with directions for its cultivation as a timber-tree in *Forestry Manual* of the Kansas State Hort. Soc. 1881, 10.

[2] The log specimen of Toxylon in the Jesup Collection of North American Woods in the American Museum of Natural History in New York, grown in southern Arkansas, is twenty-four inches and a half in diameter, and shows one hundred and thirty-four layers of annual growth.

The Osage Orange can be easily raised from seeds which germinate the first season, or from cuttings of the roots.

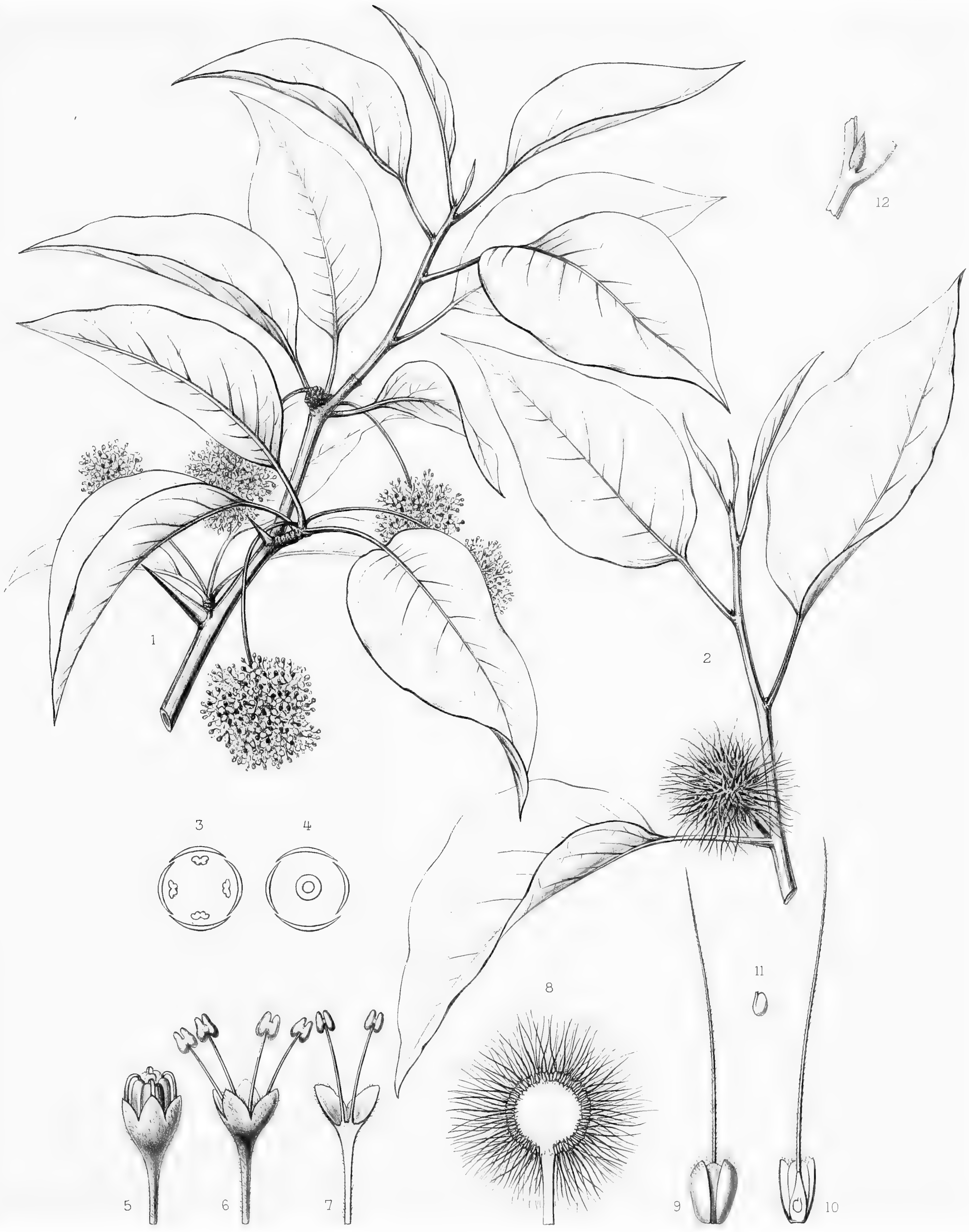
EXPLANATION OF THE PLATES.

PLATE CCCXXII. TOXYLON POMIFERUM.

1. A flowering branch of the staminate tree, natural size.
2. A flowering branch of the pistillate tree, natural size.
3. Diagram of a staminate flower.
4. Diagram of a pistillate flower.
5. A staminate flower just before anthesis, enlarged.
6. A staminate flower, enlarged.
7. Vertical section of a staminate flower, enlarged.
8. Vertical section of a head of pistillate flowers, enlarged.
9. A pistillate flower, enlarged.
10. Vertical section of a pistillate flower, enlarged.
11. An ovule, much magnified.
12. A stipule, enlarged.

PLATE CCCXXIII. TOXYLON POMIFERUM.

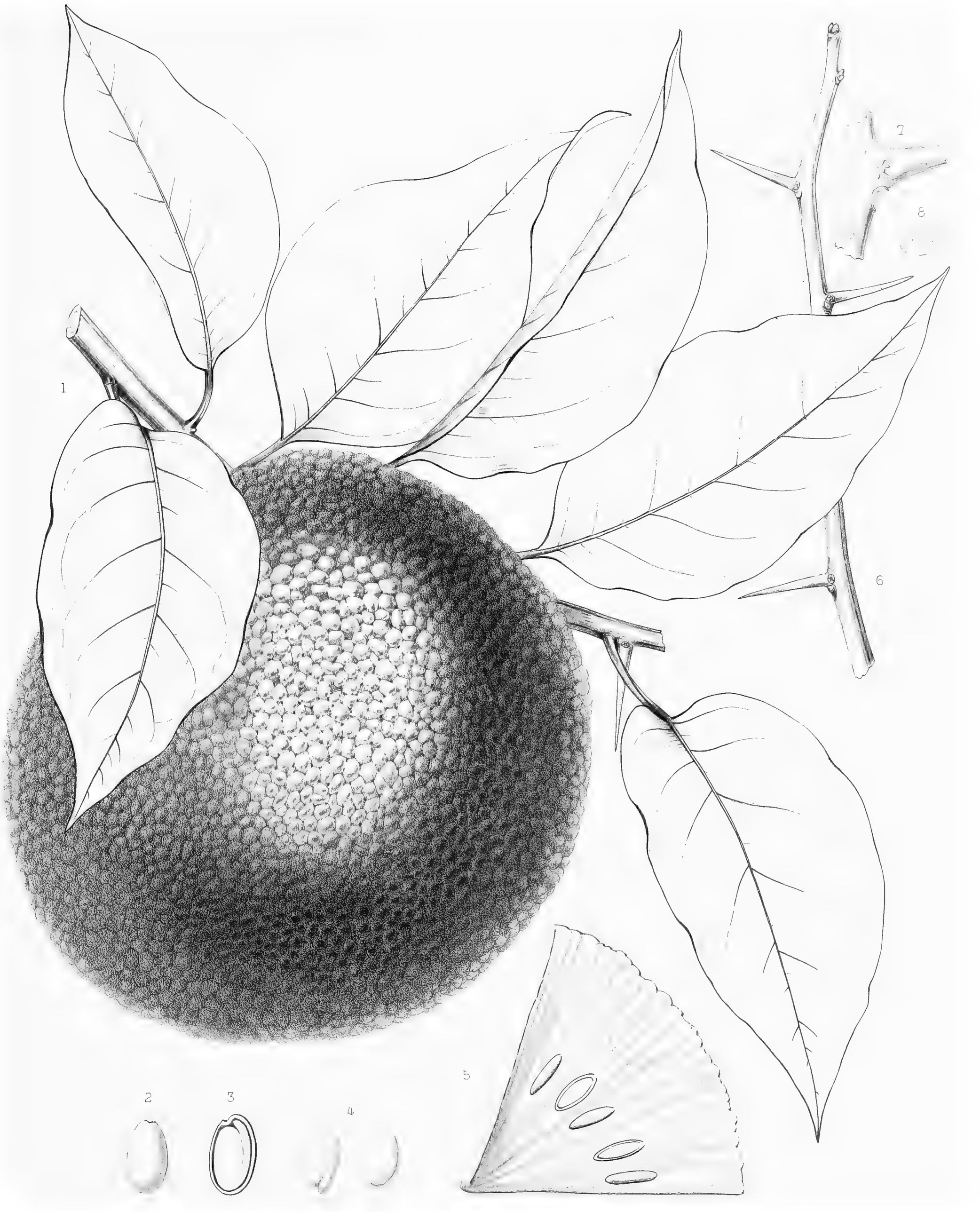
1. A fruiting branch, natural size.
2. A nutlet, enlarged.
3. Vertical section of a nutlet, enlarged.
4. An embryo seen from the two sides, enlarged.
5. Section of a syncarp, natural size.
6. A winter branchlet, natural size.
7. Portion of a winter branchlet with a spine and lateral bud, enlarged.
8. A leaf-scar, enlarged.



C.E.Faxon del. *Rapine sc.*

TOXYLON POMIFERUM, Raf.

A.Riocreux direx.t *Imp. J. Taneur, Paris.*



C. E. Faxon del.

Himely sc.

TOXYLON POMIFERUM, Raf.

A. Riocreux direx.t

Imp. J. Taneur, Paris

FICUS.

FLOWERS mostly unisexual, usually monœcious or diœcious, collected on a concave receptacle closed at the apex; calyx 2 to 6-parted or divided, the divisions imbricated in æstivation; corolla 0; stamens 1 to 3; disk 0; ovary superior, 1-celled; ovule solitary, suspended. Fruit drupaceous, more or less immersed in the thickened fleshy receptacle. Leaves alternate or rarely opposite, stipulate, persistent, or deciduous.

Ficus, Linnæus, *Gen.* 321 (1737). — Adanson, *Fam. Pl.* ii. 377. — A. L. de Jussieu, *Gen.* 400. — Endlicher, *Gen.* 278. — Meisner, *Gen.* 350. — Baillon, *Hist. Pl.* vi. 208. — Bentham & Hooker, *Gen.* iii. 367. — G. King, *Jour. Linn. Soc.* xxiv. 42. — Engler & Prantl, *Pflanzenfam.* iii. pt. i. 89.

Gonosuke, Rafinesque, *Sylva Tellur.* 58 (1838).

Varinga, Rafinesque, *Sylva Tellur.* 58 (1838).

Necalistis, Rafinesque, *Sylva Tellur.* 58 (1838).

Oluntos, Rafinesque, *Sylva Tellur.* 58 (1838).

Perula, Rafinesque, *Sylva Tellur.* 58 (1838).

Rephesis, Rafinesque, *Sylva Tellur.* 59 (1838).

Tremotis, Rafinesque, *Sylva Tellur.* 59 (1838).

Mastosuke, Rafinesque, *Sylva Tellur.* 59 (1838).

Caprificus, Gasparini, *Nov. Gen. Fic.* 6 (1844).

Urostigma, Gasparini, *Nov. Gen. Fic.* 9 (1844).

Visiania, Gasparini, *Nov. Gen. Fic.* 9 (1844).

Covellia, Gasparini, *Nov. Gen. Fic.* 10 (1844).

Galoglychia, Gasparini, *Nov. Gen. Fic.* 10 (1844).

Sycomorphe, Miquel, *Ann. Sci. Nat.* sér. 3, i. 35 (1844).

Macrophthalma, Gasparini, *Ricerch. Caprif.* 83, t. 7 (1845).

Erythrogyne, Visiani; *Gasparini Ricerch. Caprif.* 86 (1845).

Sycomorus, Gasparini, *Ricerch. Caprif.* 86 (1845).

Plagiostigma, Zuccarini, *Abhand. Acad. Münch.* iv. pt. i. 154 (1845).

Tenorea, Gasparini, *Ann. Sci. Nat.* sér. 3, iii. 342 (1845).

Cystogyne, Gasparini, *Ann. Sci. Nat.* sér. 3, iii. 345 (1845).

Synœcia, Miquel, *Hooker Lond. Jour. Bot.* vi. 525 (1847).

Pharmacosycea, Miquel, *Hooker Lond. Jour. Bot.* vii. 64 (1848).

Pogonotrophe, Miquel, *Hooker Lond. Jour. Bot.* vii. 72 (1848).

Trees or shrubs, sometimes scandent, often epiphytal, with thick milky juice, naked or rarely scaly buds, and thick fleshy roots which are frequently produced from the branches, and, entering the ground, enlarge and form supplementary stems, so that an individual often gradually spreads over a large area, and lives to a great age. Leaves alternate or rarely opposite, entire, serrate, dentate, or sometimes lobed, penniveined, persistent or deciduous; stipules deciduous, often fugacious, interpetiolar, embracing the leaf-bearing axis and inclosing the young leaves, or lateral in pairs at the base of the petiole, or rarely in some annual-leaved species scale-like, minute, covering the leaf-buds. Flower-bearing receptacle homorphous or rarely dimorphous, globose, ovoid, ellipsoidal, obovate, or pyriform, narrowed, and often contracted at the base into a short stipe, sessile or pedunculate, solitary by abortion, or in pairs, in the axils of existing or fallen leaves, or in axillary fascicles or on abbreviated leafless lateral branchlets from the trunk or large branches, or in long nearly leafless branches close to the ground, and more or less hypogæus, or very rarely in dense heads arranged on long pendulous leafless branches; sometimes inclosed while young in a posterior hood-like caducous involucre, usually surrounded at the base by three anterior bracts, distinct or united into an involucral cup, bearing on the interior at the apex numerous rows of minute triangular viscid bracts closing the orifice, those of the lower rows turned downward into the cavity of the receptacle and infolding the upper flowers, those immediately above these horizontal, and the upper rows projecting from the orifice and forming a more or less prominent umbilicus, or occasionally united into a ring surrounding the orifice. Flowers sessile or pedicellate, the pedicels thickening and becoming succulent with the ripening of the fruit, unisexual, occasionally

perfect, gall,[1] or rarely asexual, often separated by chaffy scales or hairs; the staminate, gall, and fertile flowers collected on the same receptacle, or the staminate and gall flowers on distinct receptacles, with the perfect and asexual flowers on others, or the staminate and gall flowers on one set of receptacles, and the pistillate on another set. Calyx of the staminate flower usually divided into two to six sepals, or gamopetalous and two to six-lobed, or wanting. Stamens one or two, or rarely three; filaments short, erect, or rarely elongated, when more than one united throughout their length; anthers innate or rarely adnate, ovate, broad and subrotund, two-celled, the cells opening longitudinally; wanting in the pistillate and gall flowers. Sepals or lobes of the calyx of the fertile and gall flowers usually narrower than those of the staminate flower. Ovary sessile, erect, or oblique, surmounted by the elongated lateral style, crowned with a clavate cylindric peltate, or two-lobed stigma; wanting in the pistillate flower; ovule solitary, suspended from the apex or laterally below the apex of the cell, anatropous. Gall flower long-pedicellate, the ovary ovoid or globular, crowned with a usually abbreviated often central style, occupied by the pupa of a hymenopterous insect. Fruit drupaceous, mostly immersed in the thickened succulent receptacle, obovoid or reniform, rarely globular; exocarp thin, mucilaginous; endocarp thin, crustaceous, minutely tuberculate. Seed suspended; testa membranaceous. Embryo curved in thin fleshy albumen; cotyledons equal or unequal, longer than the incumbent radicle.[2]

Ficus, of which about six hundred species[3] have been described, is widely distributed through the

[1] The term gall flower, proposed by Solms-Laubach (*Bot. Zeit.* xliii. Nos. 513, 529, 545, 561 [*Die Geschlechterdifferenzirung bei den Feigenbäumen*]) for certain pistillate flowers of Ficus used by insects as nests in which to deposit their eggs, has been adopted by G. King in his *Species of Ficus of the Indo-Malayan and Chinese Countries* (*Ann. Bot. Gard. Calcutta*, i.). As described by Dr. King, the gall flowers resemble in many cases the fertile pistillate flowers, with a similar calyx, and an ovary and style, although the style is more terminal, shorter, straighter, and broadly dilated at the apex, which is slightly if at all stigmatic. In their later stages gall flowers can be distinguished from the fertile fruit by their longer pedicels and more globular shape, and by the smooth not tuberculate pericarp without fleshy covering. Their peculiarities of structure are not believed to be the results of insect visitations, but to have led to their selection by insects as their nests. In many species of Ficus, especially in those of the section Urostigma, no external difference between the fertile female and the gall flowers exist, and it is only possible to distinguish the female by opening the ovaries.

No investigations of the flowers of the two Florida species of Ficus with reference to their fertilization by insects have been made; and we have been unable to find in the receptacles preserved in the herbarium any traces of the pupæ of insects in the female flowers, which in both species vary in the length of the pedicels, or in the fruit, which is frequently hollow.

[2] By G. King (*l. c.* 1) Ficus is divided into the following sections, several of which were first characterized by Miquel (*Ann. Mus. Lugd. Bat.* iii. 214, 260):—

Palæomorphe. Staminate and gall flowers in different receptacles from those containing the pistillate flowers, the staminate with a single stamen and a rudimentary pistil. Small trees or erect or subscandent shrubs.

Urostigma. Flowers unisexual; receptacles usually tribracteate at the base, axillary; staminate, pistillate, and gall flowers in the same receptacle; stamen 1 or rarely 2; stigmas elongated, usually acute; leaves alternate, entire, coriaceous, subcoriaceous, or rarely membranaceous. Usually trees or large climbing shrubs, epiphytal in youth.

Synœcia. Flowers unisexual or asexual, the staminate and gall flowers in one set of receptacles, the pistillate and asexual flowers in another; stamen 1 or very rarely 2; leaves tessellate on the lower surface; receptacles large and colored. Climbing shrubs.

Sycidium. Flowers unisexual, the staminate and gall flowers in one set of receptacles, the pistillate flower in another; stamen 1 or very rarely 2; receptacles generally axillary, more or less scabrate. Small trees or shrubs, sometimes climbing, rarely epiphytal.

Covellia. Flowers unisexual; staminate and gall flowers together in one set of receptacles, the pistillate flowers in another; calyx of the staminate flower divided into three or four sepals; stamen 1; calyx of the pistillate flower gamophyllous or rarely of four or five sepals much shorter than the ovary, or wanting; receptacles on long aphyllous branches produced near the base of the stem, often subhypogæus, or on abbreviated branchlets from the stem or large branches, or axillary. Trees or shrubs, not climbing or epiphytal.

Eusyce. Flowers unisexual, the male and gall flowers in one set of receptacles, the pistillate flowers in another; stamens usually 2, rarely 1 or 3; receptacles axillary; leaves alternate, villous or glabrous, deciduous or persistent. Small trees or shrubs, scandent or erect, rarely epiphytal.

Neomorphe. Flowers unisexual, the male and gall flowers in one set of receptacles, the pistillate flowers in another and smaller; calyx inflated into three or four membranaceous sepals; stamens 2; receptacles large, fascicled on abbreviated branchlets from the stem or large branches. Trees, usually scandent, not epiphytal.

[3] Humboldt, Bonpland & Kunth, *Nov. Gen. et Spec.* ii. 117.—Blume, *Bijdr. Fl. Ned. Ind.* ii. 436.—Miquel, *Ann. Sci. Nat.* sér. 3, i. 31; *Hooker Lond. Jour. Bot.* vi. 514; vii. 563; *Verh. Acad. Amst.* i. 111 (*Afrik Vijge-Boom.*); *Martius Fl. Brasil.* iv. pt. i. 106; *Ann. Mus. Lugd. Bat.* iii. 214, 260.—Liebmann, *Dansk. Vidensk. Selsk. Skrift.* ser. 3, ii. 319.—Bentham, *Fl. Austral.* vi. 160.—Grisebach, *Fl. Brit. W. Ind.* 150.—Seemann, *Fl. Vit.* 247.—Franchet & Savatier, *Enum. Pl. Jap.* i. 434.—Baker, *Fl. Maur. & Seychel.* 283.—Kurz, *Forest Fl. Brit. Burm.* ii. 435.—Parodi, *Ann. Soc. Cienc. Argent.* v. 87 (*Contrib. Fl. Parag.* 35).—Boissier, *Fl. Orient.* iv. 1153.—Hemsley, *Bot. Biol. Am. Cent.* iii. 143.—G. King, *l. c.*; *Hooker f. Fl. Brit. Ind.* v. 494.—Watson, *Proc. Am. Acad.* xxiv. 77; xxvi. 150.

tropics of both hemispheres, the largest number being found on the islands of the Malay Archipelago and the Pacific Ocean; a few species extend beyond the tropics into Mexico, southern Florida, which is inhabited by two indigenous Fig-trees, Argentina, southern Japan and China, the countries bordering the Mediterranean, the Canary Islands, and southern Africa. The type is an ancient one, having existed in the cretaceous age, when several species of Ficus flourished in Europe,[1] and during tertiary times in North America, where Ficus then abounded with many species in the northern Rocky Mountain region [2] and ranged to the shores of the Pacific Ocean.[3]

Some of the species of Ficus produce edible fruit, the most valuable as fruit-trees being *Ficus Carica*,[4] the type of the genus, and *Ficus Sycomorus*.[5] From the thick milky juice of others India rubber is made.[6] All the species produce soft light perishable wood.

[1] Saporta, *Origine Paléontologique des Arbres*, 204. — Zittel, *Handb. Palæontolog.* 478, f. 283–285.

[2] Lesquereux, *U. S. Geolog. Surv.* vii. 191, t. 28–35, 61–63; viii. 45, t. 1, f. 12, 13, t. 14, f. 4, t. 16, f. 5, t. 17, f. 3–6 (*Contrib. Foss. Fl. Western Territories*, ii., iii.). — L. F. Ward, 6*th Ann. Rep. U. S. Geolog. Surv.* 1884–85, 552, t. 44–46 (*Syn. Fl. Laramie Group*).

[3] Lesquereux, *Mem. Mus. Comp. Zoöl.* vi. pt. ii. 17, t. 4, f. 6–11 (*Fossil Plants of the Auriferous Gravel Deposits of the Sierra Nevada.*)

[4] Linnæus, *Spec.* 1059 (1753). — Hayne, *Arzn.* ix. t. 13. — Parlatore, *Fl. Ital.* iv. 367. — Brandis, *Forest Fl. Brit. Ind.* 418. — Boissier, *Fl. Orient.* iv. 1154.

Caprificus insectifera, Gasparini, *Nov. Gen. Fic.* 6 (1844).

Ficus Carica, whose succulent receptacles are the edible figs of commerce, has been cultivated from ancient times, and now grows spontaneously from Afghanistan and eastern Persia through all the Mediterranean region to the Canary Islands, being arrested to the north by the mountains of the Caucasus and western Europe. The evidence collected by A. de Candolle (*Origine des Plantes Cultivées*, 235) seems to fix its prehistoric home in the Mediterranean basin from Syria to the Canary Islands, although in the case of a plant like the Fig-tree, cultivated for centuries for its food, with minute seeds which do not lose vitality in the process of animal digestion, it is not easy to decide to what extent its habitat has been extended by the agency of man.

The Fig-tree was known and cultivated by the ancient Egyptians, and is mentioned in the oldest books of the Hebrew race. Numerous varieties were originated and valued by the Greeks, one of these from Caria in Asia Minor furnishing the Fig-tree with its scientific name. *Ficus Carica*, which is now cultivated in innumerable varieties in all temperate countries, supplies the people of southern Europe and western Asia with one of their most important articles of food; the fruit is eaten fresh and dried, and dried figs are now exported from Asia Minor, which is the great Fig-producing region, to North America and all the countries of Europe. Figs are slightly laxative, and are sometimes used in the treatment of chronic constipation (Flückiger & Hanbury, *Pharmacographia*, 487. — *U. S. Dispens.* ed. 16, 711).

The staminate and gall flowers of *Ficus Carica* occupy elongated receptacles borne on one individual, and the pistillate flowers a globose or pyriform receptacle on another. The difference in the shape, size, and general appearance of the two receptacles is so great that the trees producing them were long considered distinct, that with the staminate and gall flowers being called the Caprifig and the other the Fig. Vague ideas of the sexual relations of the two plants led to the practice of caprification, which was originated by the Greeks, and is still used in Asia Minor and in some parts of southern Europe, and has lately been introduced into California. It consists in placing the receptacle-bearing branches of the Caprifig on Fig-trees at the fruiting season or in planting occasional Caprifigs in Fig orchards in order that the female insects which are hatched from eggs laid in the gall flowers of the Caprifig may enter the receptacles of the Fig-tree, and insure the fertilization of the pistillate flowers with pollen carried from the staminate flowers of the Caprifig.

D. D. Cunningham, from investigations made on *Ficus Roxburghii*, Miquel, in the Botanic Garden of Calcutta (*Ann. Bot. Gard. Calcutta*, i. Appx. 1, t. 1–5) reached the conclusion that the fertilization of this species at least is asexual, the female flower being prolific without pollen when visited by Blastophaga, whose visit to the staminate flower is also necessary to insure the production of pollen. Although Linnæus (*Hort. Cliff.* 471) recognized the fact that the Fig and the Caprifig were male and female forms of the same species, later botanists continued to consider them specifically distinct, and Gasparini placed the two trees in distinct genera, Ficus and Caprificus (*Nov. Gen. Fic.* 6), the view which was maintained by the Dutch botanist Miquel (Hooker, *Lond. Jour. Bot.* vii. 222). By others the Caprifig has been considered the wild type from which the cultivated Fig has been derived (Solms-Laubach, *Abhandl. Gesell. Wiss. Gött.* [*Die Herkunft, Domestication und Verbreitung der gewöhnlichen Feigenbaum*]). Fritz Müller (*Kosmos*, xi. 306), however, established the fact, now generally recognized, that the two plants were sexual forms of one species; and while the action of the insect (*Blastophaga grossorum*, Gravenhorst) appears to be necessary to insure the fertilization of the ovaries and the production of seeds, caprification from an economic point of view in the case of some varieties, at least, has probably little practical significance, as the receptacles containing the female flowers, which are the edible figs, often grow without reference to the production of seeds. (See, also, Paul Meyer, *Mittheil. Zoölog. Stat. Neap.* iii. 551 [*Zur Naturgeschichte der Feigeninsecten*]). — Hemsley, *Nature*, xxvii. 584. — Hermann Müller, *The Fertilization of Flowers*, English ed. 521. — *Annual Rep. California State Board Agriculture*, 1891, 227).

[5] Linnæus, *l. c.* (1753). — Forskal, *Fl. Ægypt-Arab.* 180. — Boissier, *l. c.* 1155.

Sycomorus antiquorum, Miquel, *Hooker Lond. Jour. Bot.* vii. 109. — Gasparini, *Ricerch. Caprif.* 86.

A native of Egypt and Abyssinia, *Ficus Sycomorus*, which is a large tree with a dense spreading crown, is often planted in Egypt in avenues. The fruit, which is very inferior to that of *Ficus Carica*, is frequently used by the wild tribes, and is eaten by animals. From the wood the mummy cases of the ancient Egyptians were made.

[6] As a rubber-producing plant, *Ficus elastica* (Blume, *Bijdr. Fl. Ned. Ind.* i. 446. — Roxburgh, *Fl. Ind.* ed. 2, iii. 541. — G. King, *Ann. Bot. Gard. Calcutta*, i. 45, t. 54; *Hooker f. Fl. Brit. Ind.* v. 509), a

In all tropical countries Fig-trees, usually of the section Urostigma, are cultivated for shade and ornament; and in India, Ceylon, and Burmah *Ficus religiosa*,[1] sacred to Buddha, is planted near his temples, and cherished by his followers.

The North American species of Ficus are not known to suffer from the attacks of insects or fungal diseases.

Ficus, from *σῦκον*, the classical name of the Fig-tree, was adopted by Tournefort[2] and afterward by Linnæus.

native of the eastern Himalayas, Assam, Burmah, and Malaya, is probably the most valuable species of the genus, although the rubber it yields is less valuable than that obtained from several species of Hevia of tropical America. It is a noble tree, sometimes a hundred feet high, with enormous trunks and long roots, which form a network on the surface of the ground (*Garden and Forest*, ii. 544, f. 143).

Ficus elastica is planted as a shade and avenue tree in all tropical countries, and is largely used outside the tropics for the decoration of conservatories and living-rooms. In Assam large plantations of this tree have been made since 1873 for the production of rubber (Mann, *Forest Administration in Assam*, 1874–75, 28 [*Rep. Forest Dept. India*, 1875]. — Brandis, *Suggestions regarding Forest Administration in Assam*, 61 [*Ibid.* 1879]. — Strettel, *The Ficus Elastica in Burma Proper* [Rangoon, 1876]).

The sap is extracted by incisions made about a foot apart through the bark of the trunk and principal branches up to the top of the tree. On exposure to the air the juice separates spontaneously into a hard elastic substance and into a fetid whey-like colorless liquid. (See Balfour, *Encyclopædia of India*, ed. 3, i. 1099.)

[1] Linnæus, *Spec.* 1059 (1753). — Blume, *Bijdr. Fl. Ned. Ind.* i. 436. — Roxburgh, *Fl. Ind.* ed. 2, iii. 547. — Kurz, *Forest Fl. Brit. Burmah*, ii. 448. — G. King, *Ann. Bot. Gard. Calcutta*, i. 55, t. 67, A. 84, U.; *Hooker f. Fl. Brit. Ind.* v. 513.

Ficus affinior, Griffith, *Notul.* iv. 392, t. 553 (1854).

Ficus caudata, Stokes, *Bot. Mat. Med.* iv. 358 (1812).

Urostigma religiosum, Gasparini, *Ricerch. Caprif.* 82, t. 7, f. 1 (1845). — Miquel, *Hooker Lond. Jour. Bot.* vi. 563; *Fl. Ind. Bat.* i. pt. ii. 333, t. 23.

Urostigma affine, Miquel, *Hooker Lond. Jour. Bot.* vi. 564 (1847).

The Pipal tree is a native of Bengal and central India, and is commonly planted through all the warmer regions of southern Asia. It is the most sacred tree of the Buddhists, and is also venerated by the Hindoos because Vishnu is believed to have been born under the shade of its wide-spreading branches. Silk-worms are said to flourish on its leaves; the bark is tonic; and lac of good quality is obtained from it (Brandis, *Forest Fl. Brit. Ind.* 415. — Balfour, *l. c.* 1101).

[2] Tournefort, *Inst.* 662, t. 420.

CONSPECTUS OF THE NORTH AMERICAN SPECIES.

UROSTIGMA. Flowers unisexual, united in the same receptacle; stamen 1; anther adnate; receptacles axillary, inclosed in a caducous cucullate bract, tribracteate at the base; leaves alternate, entire, coriaceous, inclosed in the bud in the interpetiolar caducous stipules marking the branches in falling with narrow ring-like scars.

Receptacles subglobose, sessile, or short-pedunculate; leaves oblong, usually pointed at both ends . 1. F. AUREA.

Receptacles obovate, long or short-pedunculate; leaves broadly ovate, cordate . . . . . 2. F. POPULNEA.

FICUS AUREA.

RECEPTACLES subglobose, sessile, or short-pedunculate. Leaves oblong-lanceolate, usually pointed at both ends.

Ficus aurea, Nuttall, *Sylva*, ii. 4, t. 43 (1849). — Chapman, *Fl.* 415. — Sargent, *Forest Trees N. Am.* 10*th Census U. S.* ix. 126.

Ficus aurea, var. **latifolia**, Nuttall, *Sylva*, ii. 4 (1849).

A round broad-topped parasitic tree, fifty or sixty feet in height, germinating and growing at first on the trunks or branches of other trees, and sending down to the ground stout aerial roots, which, gradually growing together and strangling its host, form a trunk often three or four feet in diameter, while other roots produced from the branches fix themselves in the ground, grow into trunks, and extend the tree over a large area. The bark of the trunk is half an inch thick, smooth, ashy gray, or light brown slightly tinged with orange, and broken on the surface into minute appressed scales which, in falling, disclose the nearly black inner bark. The branchlets are stout, terete, pithy, light orange-colored, and marked with pale lenticels, conspicuous stipular scars, large slightly elevated horizontal oval leaf-scars in which appear a marginal ring of large pale fibro-vascular bundle-scars, and smaller elevated concave circular scars left by the receptacles in falling. The leaves are involute in vernation, oblong, usually narrowed at both ends, acute, or acuminate with short broad points at the apex, wedge-shaped or rarely broad and rounded at the base, two to five inches long, an inch and a half to three inches wide, thick and coriaceous, dark yellow-green and lustrous above, and paler and rather less lustrous below, with broad light yellow midribs slightly grooved on the upper side, and numerous obscure primary veins arcuate and united near the margins and connected by fine closely reticulated veinlets; they are borne on stout slightly grooved petioles, half an inch to an inch in length, and, continuing to unfold during a large part of the year, usually fall during their second season. The stipules, which are ovate-lanceolate, thick and firm, tinged with red, and about an inch long, inclose the leaf in a slender sharp-pointed bud-like covering. The receptacles, which develop in succession as the branch lengthens, are axillary, subglobose, sessile, or short-pedunculate, and solitary or often in pairs, with a lateral orifice marked by a small point formed by the union of the minute bracts with which it is closed; when they first appear they are partly inclosed by a thin broadly ovate membranaceous light brown hood-like caducous posterior bract, and are furnished at the base with three ovate rounded persistent anterior bracts, the central one being outside the others, and rather smaller; when they are fully grown, they are about one third of an inch in diameter, and yellow, but ultimately turn bright red. The flowers are reddish purple, separated by minute reddish chaff-like scales, more or less laciniate at the apex, and are sessile or long-pedicellate. The calyx of the staminate flower is divided to below the middle into two or three broad lobes rather shorter than the stout flattened filament. The lobes of the anther are oblong, and attached laterally to the broad connective. The calyx of the pistillate flower is divided to the middle into four or five narrow lobes, and closely invests the ovate sessile ovary surmounted by a slender lateral clavate style two-lipped at the apex. The fruit is ovate, inclosed at the base by the persistent calyx, crowned with the remnants of the style, and immersed in the thickened reddish-purple walls of the receptacle; it has a thin fleshy outer covering and a thick-walled light brown crustaceous nutlet. The seed is ovate and rounded at both ends, with a thin light brown testa, and a large lateral oblong pale hilum.

Ficus aurea is a common inhabitant of woody hummocks on the shores and islands of southern Florida, where it is distributed from the Indian River on the east coast and from the shores and islands

of Tampa Bay on the west coast[1] to the southern keys, attaining its largest size in the neighborhood of Bay Biscayne;[2] it also inhabits the Bahama Islands.[3]

The wood of *Ficus aurea* is exceedingly light, soft, very weak, coarse-grained, and very perishable in contact with the ground; it is light brown, with thick lighter colored sapwood, and contains numerous thin hardly distinguishable medullary rays. The specific gravity of the absolutely dry wood is 0.2616, a cubic foot weighing 16.30 pounds.

The earliest account of *Ficus aurea* appears in Bernard Romans's *Natural History of Florida*,[4] published in 1775. It is sometimes planted as a shade-tree on Key West,[5] and has lately been introduced into the gardens of the United States and Europe.

[1] P. W. Reasoner, *Garden and Forest*, i. 214.

[2] What is probably the largest specimen of *Ficus aurea* in the United States grows on a wooded hummock, locally known as "The Hunting-ground," about ten miles west of the mouth of the Miami River and close to the shores of Bay Biscayne. This remarkable tree covers about a quarter of an acre of ground with its numerous distinct stems formed from roots developed from the branches of the original trunk, and its dense wide crown of foliage (*Garden and Forest*, i. 128, f.).

[3] Brace, No. 356, Herb. Kew.

[4] *Ficus Americana, citri folio, fructu parvo purpureo*, 21.

[5] The noble tree in front of the United States barracks on Key West, which is an object of interest to all visitors to the Island, is of this species.

EXPLANATION OF THE PLATE.

PLATE CCCXXIV. FICUS AUREA.

1. A flowering and fruiting branch, natural size.
2. A pair of young receptacles covered by their posterior cucullate bract, enlarged.
3. A receptacle, side view, enlarged.
4. A receptacle, front view, enlarged.
5. Vertical section of a receptacle, enlarged.
6. Section of a receptacle, showing the flowers, enlarged.
7. A staminate flower, enlarged.
8. A stamen, rear view, enlarged.
9. A pistillate flower, enlarged.
10. A fruit, enlarged.
11. Vertical section of a fruit, enlarged.
12. A seed, enlarged.
13. An embryo, much magnified.
14. Portion of branch showing leaf and receptacle scars, natural size.

C.E. Faxon del. Himely sc.

FICUS AUREA, Nutt.

A. Riocreux direx.t Imp. J. Taneur, Paris

FICUS POPULNEA.

RECEPTACLE obovate, long or short-pedunculate. Leaves broadly ovate, cordate.

Ficus populnea, Willdenow, *Spec.* iv. 1141 (1805). — A. Richard, *Fl. Cub.* iii. 220. — Grisebach, *Fl. Brit. W. Ind.* 151; *Cat. Pl. Cub.* 57. — Miquel, *Ann. Mus. Lugd. Bat.* iii. 298. — Eggers, *Bull. U. S. Nat. Mus.* No. 13, 94 (*Fl. St. Croix and the Virgin Islands*). — Sargent, *Garden and Forest*, ii. 448.

Urostigma populneum, Miquel, *Hooker Lond. Jour. Bot.* vi. 537, t. 21 A. (1847).

Ficus pedunculata, Nuttall, *Sylva*, ii. 1, t. 41 (not Aiton) (1849). — Chapman, *Fl.* 415. — Sargent, *Forest Trees N. Am.* 10*th Census U. S.* ix. 127.

Ficus brevifolia, Nuttall, *Sylva*, ii. 3, t. 42 (1849). — Chapman, *Fl.* 415. — Sargent, *Forest Trees N. Am.* 10*th Census U. S.* ix. 127.

A tree, sometimes epiphytal, rarely forty to fifty feet in height, with a trunk twelve to eighteen inches in diameter, spreading branches, from which, in Florida, aerial roots are occasionally produced, and an open irregular head. The bark of the trunk is one third to one half of an inch in thickness, and is smooth and light brown tinged with orange, separating into minute scales, which cover the bright red-brown inner bark. The branches are stout and terete, and, when they first appear, are light red and slightly puberulous, becoming brown tinged with orange and later with red, and marked with minute pale lenticels, narrow stipular scars, large elevated horizontal oval or semiorbicular leaf-scars, in which appear a marginal row of conspicuous fibro-vascular bundle-scars, and elevated concave receptacle-scars. The leaves are involute in vernation, broadly ovate, or rarely obovate, contracted into short broad points or occasionally rounded at the apex, rounded, truncate or cordate at the base, two and one half to five inches long, one and a half to three inches wide, thin and firm, dark green and lustrous on the upper surface and paler on the lower surface, with broad light yellow midribs slightly impressed on the upper side, slender remote primary veins, arcuate and united near the margins and connected by finely reticulate veinlets, and slender grooved petioles, sometimes an inch in length. The stipules are ovate-lanceolate, half an inch long, and tinged with red. The receptacles are obovate, axillary, solitary, or in pairs, at first covered with a hood-like membranaceous light brown caducous posterior bract, and surrounded at the base by three small ovate acute light brown nearly equal persistent bracts; they are yellow until fully grown, ultimately turning bright red, and one quarter to one half of an inch in length, and are borne on stout drooping peduncles one quarter of an inch to an inch long. The flowers are sessile or pedicellate, and separated by minute chaff-like scales, more or less laciniate at the apex; in the males the calyx is divided nearly to the base into three or four broad acute lobes; the stamen is composed of a broad flattened filament and an innate anther; in the females the narrow calyx-lobes are shorter than the ovate pointed ovary, which is crowned with broad spreading stigmatic lobes. The fruit is ovate, nearly inclosed in the persistent calyx, and crowned with the remnants of the style; the nutlet is thick-walled, light brown, crustaceous, and is covered by a thin layer of membranous flesh. The seed is ovate, with a membranaceous light brown testa and an oblong lateral pale hilum.

In Florida, where it is comparatively rare, *Ficus populnea* is confined to the shores of Bay Biscayne, Key Largo, Umbrella, Bocca Chica, and Pumpkin keys, and Key West, growing usually on dry slightly elevated coral rock; it is also an inhabitant of the West Indies.

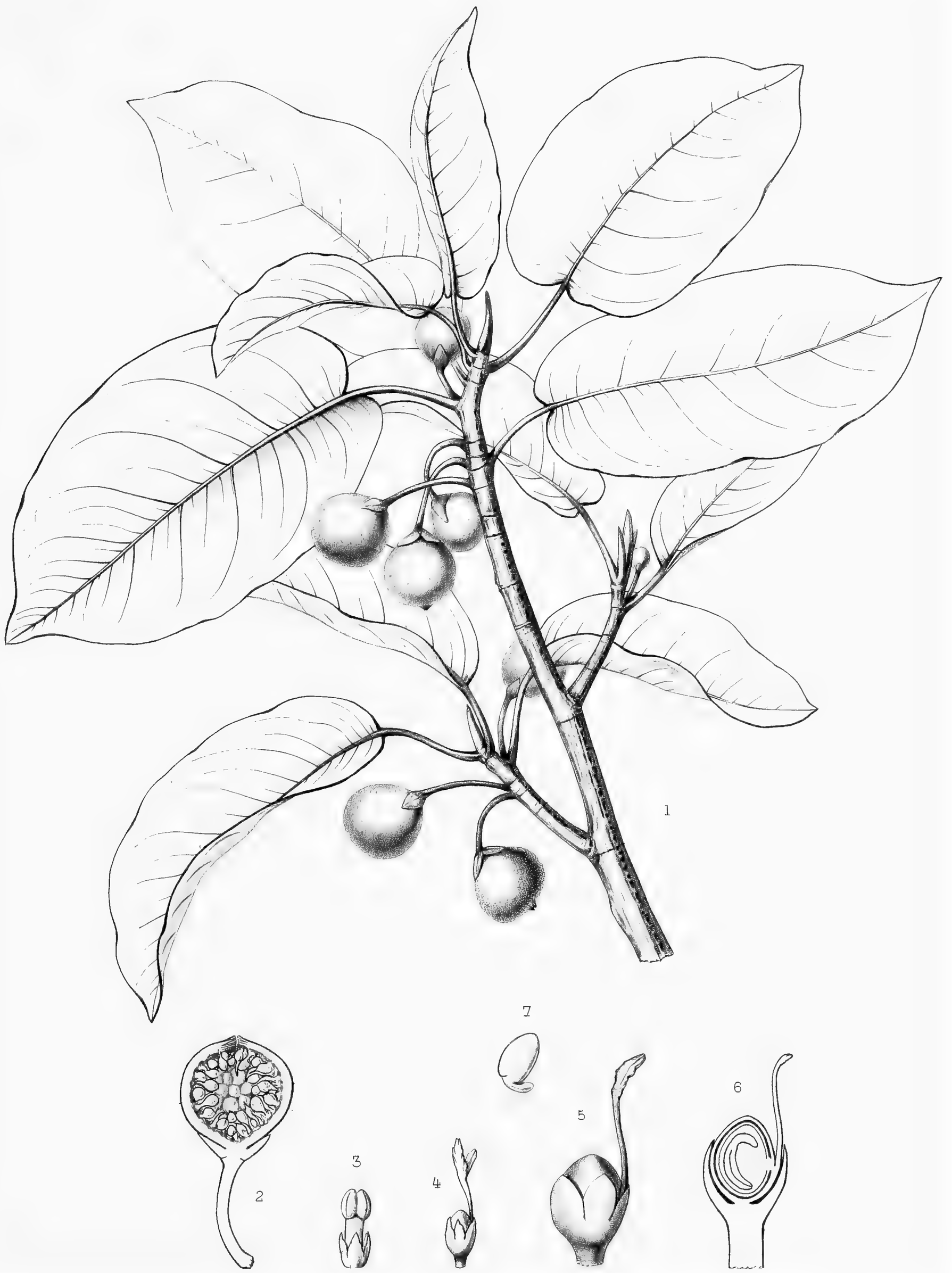
The wood of *Ficus populnea* is light, soft, and close-grained, containing many thin conspicuous medullary rays, large open scattered ducts, and numerous groups of smaller ducts arranged in concentric circles; it is light orange-brown or yellow, with thick hardly distinguishable sapwood. The specific gravity of the absolutely dry wood is 0.5568, a cubic foot weighing 34.69 pounds.

Ficus populnea was discovered in Florida on Key West, from which it has now nearly disappeared, by Dr. J. L. Blodgett.

EXPLANATION OF THE PLATE.

PLATE CCCXXV. FICUS POPULNEA.

1. A flowering and fruiting branch, natural size.
2. Vertical section of a receptacle, enlarged.
3. A staminate flower, enlarged.
4. A pistillate flower, enlarged.
5. A fruit, enlarged.
6. Vertical section of a fruit, enlarged.
7. An embryo, much magnified.



C.E.Faxon del. Himely sc.

FICUS POPULNEA, Willd.

A.Riocreux dirext Imp. J.Taneur, Paris.

PLATANUS.

FLOWERS monœcious, in dense unisexual heads; sepals 3 to 6, imbricated in æstivation; petals and stamens as many as the sepals; disk 0; ovary superior, 1-celled; ovule usually solitary, suspended. Fruit an akene. Leaves alternate, stipulate, deciduous.

Platanus, Linnæus, *Gen.* 358 (1737); ed. 2, 462. — Adanson, *Fam. Pl.* ii. 377. — A. L. de Jussieu, *Gen.* 410. — Endlicher, *Gen.* 289. — Meisner, *Gen.* 347. — Baillon, *Hist. Pl.* iii. 462. — Bentham & Hooker *Gen.* iii. 396. — Niedenzu, *Engler & Prantl Pflanzenfam.* iii. pt. ii. 140.

Trees, with watery juice, thick deeply furrowed scaly bark exfoliating from the branches and young trunks in large thin plates, terete zigzag pithy branchlets, infrapetiolar buds, and fibrous roots. Buds axillary,[1] conical, large, smooth and lustrous, nearly surrounded at the base by the narrow leaf-scars, in which appear a row of conspicuous dark fibro-vascular bundle-scars; covered by three deciduous scales, the two inner accrescent, strap-shaped, rounded at the apex at maturity and marking in falling the base of the branch with narrow ring-like scars; the outer scale surrounding the bud and splitting longitudinally with its expansion, the second light green, covered with a gummy fragrant secretion, and usually inclosing a bud in its axil,[2] the third coated with long rufous hairs. Leaves longitudinally plicate in vernation, alternate, broadly ovate, cordate, truncate, or wedge-shaped and decurrent on the petiole at the base, more or less acutely three to seven-lobed, and occasionally furnished with a more or less enlarged basal lobe,[3] the lobes entire, dentate with remote minute callous teeth, or coarsely and remotely sinuate-toothed, palmately nerved, penniveined, the veins arcuate and united near the margins and connected by inconspicuous reticulate veinlets, clothed while young, like the petioles, stipules, and young branches, with caducous stellate sharp-pointed branching hairs,[4] pale on the lower and rufous on the upper surface of the blade, long-petiolate, the petioles abruptly enlarged at the base and inclosing the buds, turning brown and withering in the autumn before falling; stipules membranaceous, laterally united below into a short tube surrounding the branch above the insertion of their leaf, acute and more or less free above, dentate or entire, thin and scarious on flowering shoots, broad and leaf-like on vigorous sterile branches, caducous, marking the branch in falling with narrow ring-like scars. Flowers minute, appearing with the unfolding of the leaves, in dense unisexual pedunculate solitary or spicate heads, the staminate and pistillate heads on separate peduncles or rarely united on the same

[1] The end of the branch of Platanus withers and falls at midsummer with or before the stipules of the upper leaf by which it is nearly inclosed, leaving, close to the upper axillary bud which the following spring prolongs the branch, an elevated orbicular dark scar, persistent for two or three years (Henry, *Nov. Act. Nat. Cur.* xviii. 534, t. 40; xxii. 291, t. 26. — Foerste, *Bull. Torrey Bot. Club*, xx. 163, t. 147, f. 9).

[2] Hitchcock, *Trans. St. Louis Acad.* vi. 138.

[3] The basal lobes, which vary greatly in size and shape, usually occur only on large leaves produced on vigorous shoots from the stumps of trees that have been cut down. They are figured by L. F. Ward (*Proc. U. S. Nat. Mus.* xi. 39, t. 17–22 [*The Palæontological History of the Genus Platanus*]; *American Naturalist*, 1878, t. 28 [*Origin of the Plane-tree*]), who regards them as evidences of the descent of our existing American Plane-trees from extinct ancestral types, as traces of the leaves of these with well developed basal lobes have been found in the rocks of the Laramie Group in the northern Rocky Mountain region.

[4] The peculiar hairs in the thick coat of tomentum which covers the young leaves and shoots of Platanus, and which, easily detached by the wind, often floats in large flakes through the air in early spring, were well described and figured by Morren (*Bull. Acad. Brux.* iv. 447, t.), who found that they produced serious bronchial inflammation when taken into the nose or mouth.

peduncle; the sterile heads dark red on axillary peduncles; the fertile heads light green tinged with red on longer terminal peduncles, the lateral heads in the spicate clusters sessile and embracing the peduncle at maturity, usually persistent on the branches during the winter. Calyx of the staminate flower divided into three to six minute scale-like sepals slightly united at the base, about half as long as the three to six cuneiform sulcate scarious pointed petals. Stamens as many as the divisions of the calyx and opposite them; filaments short or nearly obsolete; anthers elongated, clavate, two-celled, the cells opening throughout their length by lateral slits, crowned by capitate pilose truncate connectives. Calyx of the pistillate flower divided into three to six, usually into four, rounded sepals much shorter than the acute petals. Staminodia scale-like, elongated-obovate, pilose at the apex. Ovaries as many as the divisions of the calyx, superior, sessile, ovate-oblong, surrounded at the base by long ridged jointed pale hairs persistent around the fruit, gradually narrowed into long simple styles slightly dilated and excurved toward the apex, bright red, papillose-stigmatic to below the middle along the ventral suture; ovules one or rarely two, suspended laterally, orthotropous, covered with two coats. Akene elongated-obovate, rounded and obtuse or acute at the apex, crowned with the remnants of the persistent style, one-seeded, light yellow-brown; pericarp thin, coriaceous. Seed elongated-oblong, suspended; testa thin and firm, light chestnut-brown. Embryo erect in thin fleshy albumen; cotyledons oblong, about as long as the elongated cylindrical erect radicle turned toward the minute apical hilum.[1]

Platanus is now confined to temperate North America, where three species occur, to Mexico, southwestern Europe, Asia Minor, Persia, Afghanistan, and northwestern India. It flourished over a larger area and played a most important part in the forests of the northern hemisphere during the late cretaceous and the tertiary periods, when it inhabited Greenland and Arctic America in a form hardly distinguishable from the existing species of eastern North America and Europe, and then, spreading southward, was not driven from central Europe until the close of the tertiary period, during which it also inhabited with several species the mid-continental region of North America, from whence it has now entirely disappeared.[2] The genus is homorphous, and the six or seven species which are distinguished all resemble each other except in the form of the lobes of the leaves, in the amount of the pubescence on their lower surface, in the obtuse or pointed apex of the akene, and in the number of heads of flowers on the pistillate peduncles, which vary, however, in the same species.

Platanus produces hard and heavy, although not strong, light brown wood tinged with red, and containing numerous broad conspicuous medullary rays and bands of small ducts marking the layers of annual growth. The genus is not known to possess useful properties.

In southern and western Europe, Asia Minor, Abyssinia, northwestern India, and the United States, *Platanus orientalis*[3] is frequently planted as a shade-tree in streets, avenues, and parks;

[1] **Clarke**, *Ann. & Mag. Nat. Hist.* ser. 3, i. 102, t. 6, f. 9–13. — Schoenland, *Bot. Jahrb.* iv. 308.

[2] Lesquereux, *U. S. Geolog. Surv.* vii. 181, t. 25–27; viii. 44, t. 3, f. 1, t. 7, f. 5, 249, t. 56, f. 4, t. 57, f. 1–2 (*Contrib. Foss. Fl. Western Territories*, ii., iii.); *Mem. Mus. Comp. Zoöl.* vi. pt. ii. 13, t. 7, f. 12, t. 10, f. 4, 5 (*Fossil Plants of the Auriferous Gravel Deposits of the Sierra Nevada*). — L. F. Ward, *6th Annual Rep. U. S. Geolog. Surv.* 1884–85, 552, t. 40, f. 8, 9, t. 41 (*Syn. Fl. Laramie Group*). — Saporta, *Origine Paléontologique des Arbres*, 195. — Zittel, *Handb. Palæontolog.* ii. 627, f. 343. — Jankó, *Bot. Jahrb.* xi. 451.

[3] Linnæus, *Spec.* 999 (1753). — Pallas, *Fl. Ross.* i. pt. ii. 1, t. 51. — *Nouveau Duhamel*, ii. 1, t. 1. — Watson, *Dendr. Brit.* ii. 101, t. 101. — Sibthorp, *Fl. Græc.* x. 36, t. 945. — A. de Candolle, *Prodr.* xvi. pt. ii. 159. — Parlatore, *Fl. Ital.* iv. 373. — Bommer, *Les Platanes et leur Culture*, 10. — Boissier, *Fl. Orient.* iv. 1161. — Jankó, *l. c.* 449. — Hooker f. *Fl. Brit. Ind.* v. 594.

Platanus vulgaris, Spach, *Ann. Sci. Nat.* sér. 2, xv. 291 (excl. ε *angulosa*) (1841).

Platanus orientalis, of which several varieties are distinguished, grows naturally near mountain streams from the Grecian islands and peninsula to Afghanistan and Cashmere, and now occasionally spontaneously in southwestern Europe, where it was carried by the Romans, who shared with the ancient Greeks and Persians their veneration for this tree, with which they formed their groves and shaded their dwellings. (See Evelyn, *Sylva*, ed. Hunter, ii. 53. — Loudon, *Arb. Brit.* iv. 2033.) It is commonly planted as a shade-tree in the valleys of the northwestern Himalayas (Brandis, *Forest Fl. Brit. Ind.* 434), in Persia (Fraser, *Historical and Descriptive Account of Persia*, 28), and southwestern Europe, where it is now used more generally than any other tree to adorn city streets and squares (Mathieu, *Flore Forestière*, ed. 3, 373), and occasionally in the middle and north Atlantic United States, where the Oriental Plane is hardy as far north as Massachusetts. The wood is used in Persia and other countries of western Asia for furniture and the construction of houses, and it is made into trays and other small articles of domestic use (Gamble, *Man. Indian Timbers*, 345).

Platanus Mexicana[1] is occasionally used for similar purposes in the cities of northern Mexico; and *Platanus occidentalis* is sometimes planted in the United States and central and western Europe.

Platanus in North America is remarkably free from the attacks of disfiguring insects,[2] although it suffers from severe fungal diseases.[3] All the species of Platanus can be easily raised from seeds, which germinate the first year, and the varieties can be multiplied from layers or cuttings.[4]

The generic name, the classical name of the Plane-tree, from πλατύς, was adopted by Tournefort,[5] and afterward by Linnæus.

[1] Moricand, *Bull. Ferr. Bot.* 1830, 79; *Mém. Soc. Phys. Genève*, vi. 39, t. 26 (*Pl. Nouv. Am.*). — A. de Candolle, *Prodr.* xvi. pt. ii. 160. — Hemsley, *Bot. Biol. Am. Cent.* iii. 162.

Platanus occidentalis, var. *Mexicana*, Jankó, *Bot. Jahrb.* xi. 451 (1890).

This noble tree, which is planted in the streets of the cities of northwestern Mexico, is distinguished by the thick coat of silvery white tomentum which covers the under surface of the mature leaves, which, flickering in the wind, make it the most beautiful of Plane-trees.

[2] Only a few species of insects are known to live upon the American Plane-trees, and none of them cause serious injuries. *Chalcophora campestris*, Say, lives in the dead wood, and the larvæ of several moths are occasionally found upon the foliage. *Cirrha platanella*, Chambers, lives on the under side of the leaves, which are also fed upon by a number of leaf-miners, including *Nepticula platanella*, Clemens, *Nepticula maximella*, Chambers, and *Nepticula Clemensella*, Chambers. A species of Corythuca is sometimes abundant on the leaves, from which it sucks the juices, and a plant-louse, *Lachnus Platanicola*, Riley, is sometimes found on these trees.

[3] The different species of Platanus are peculiarly subject to diseases caused by fungi, several of which produce serious injury, the most widely spread being caused by the growth of *Glœosporium nervisequum*, Saccardo, which attacks *Platanus occidentalis*, *Platanus racemosa*, and the Old World *Platanus orientalis*. This fungus was first discovered in Germany more than twenty years ago, but its occurrence in the United States was not recognized by botanists until recently. It is now known to be common throughout nearly all parts of the country where *Platanus occidentalis* and *Platanus racemosa* grow spontaneously or are cultivated, and to it may perhaps be referred the cause of the disease of Platanus in the eastern states recorded as long as fifty years ago. Its external portion is small and not easily recognized except by close observation, appearing in the form of small black spots or lines which lie close to the veins of the leaves. The disease makes its appearance soon after the leaves have expanded, causing them to turn brown, shrivel, and fall. No practical remedy for it has yet been suggested, for as the mycelium of the fungus is in the leaves and petioles, and probably also in the younger stems, little benefit can be expected from spraying the trees with sulphate of copper or other poisons. A large number of other fungi are found on the trunks and branches of Platanus, although none of them cause well-defined diseases in the United States.

[4] Buc'hoz, *Dissertations sur le Cèdre du Liban, Le Platane et le Cytise*, 17. — Gasparini, *Notes sur la Culture du Sophora, du Platane et de l'Aune*, 18. — Cobbett, *Woodlands*, 470.

[5] *Inst.* 590, t. 363.

CONSPECTUS OF THE NORTH AMERICAN SPECIES.

Leaves broadly ovate, obscurely 3 to 5-lobed, the lobes mostly serrulate-toothed, truncate or rarely wedge-shaped at the base. Fruit usually solitary	1. P. OCCIDENTALIS.
Leaves deeply 5-lobed, the lobes entire, remotely and obscurely dentate or rarely sinuate-toothed, truncate or rarely slightly cordate or wedge-shaped at the base. Fruit racemose	2. P. RACEMOSA.
Leaves deeply 3 to 7-lobed, the lobes elongated, slender, entire or rarely remotely dentate, deeply cordate or rarely wedge-shaped or truncate at the base. Fruit racemose	3. P. WRIGHTII.

PLATANUS OCCIDENTALIS.

Sycamore. Buttonwood.

LEAVES broadly ovate, obscurely 3 to 5-lobed, the lobes usually serrulate-toothed, truncate or rarely wedge-shaped at the base. Head of fruit usually solitary.

Platanus occidentalis, Linnæus, *Spec.* 999 (1753). — Miller, *Dict.* ed. 8, No. 2. — Du Roi, *Harbk. Baumz.* ii. 134. — Wangenheim, *Nordam. Holz.* 31, t. 13, f. 31. — Marshall, *Arbust. Am.* 105. — Moench, *Bäume Weiss.* 78; *Meth.* 358. — Evelyn, *Sylva*, ed. Hunter, ii. 54, t. — Walter, *Fl. Car.* 237. — Abbot, *Insects of Georgia*, ii. t. 55. — Willdenow, *Berl. Baumz.* 224; *Spec.* iv. pt. 1, 474; *Enum.* 984. — Schmidt, *Oestr. Baumz.* iii. 126, t. 8. — Castiglioni, *Viag. negli Stati Uniti*, ii. 327. — Borkhausen, *Handb. Forstbot.* i. 666. — Michaux, *Fl. Bor.-Am.* ii. 163. — Poiret, *Lam. Dict.* v. 438. — *Nouveau Duhamel*, ii. 6, t. 2. — Persoon, *Syn.* ii. 573. — Desfontaines, *Hist. Arb.* ii. 545. — Du Mont de Courset, *Bot. Cult.* ed. 2, vi. 435. — Schkuhr, *Handb.* iii. 274, t. 306. — Michaux, *Hist. Arb. Am.* iii. 184, t. 3. — Pursh, *Fl. Am. Sept.* ii. 635. — Bigelow, *Fl. Boston.* 233. — Nuttall, *Gen.* ii. 219. — Hayne, *Dendr. Fl.* 171. — Elliott, *Sk.* ii. 620. — Sprengel, *Syst.* iii. 865. — Watson, *Dendr. Brit.* ii. 100, t, 100. — Audubon, *Birds*, t. 206. — Hooker, *Fl. Bor.-Am.* ii. 158. — Torrey, *Fl. N. Y.* ii. 218. — Darlington, *Fl. Cestr.* ed. 3, 283. — Agardh, *Theor. Syst. Pl.* t. 13, f. 1–2. — Hartig, *Forst. Culturpfl. Deutschl.* 446, t. 54. — Curtis, *Rep. Geolog. Surv. N. Car.* 1860, iii. 76. — Chapman, *Fl.* 418. — A. de Candolle, *Prodr.* xvi. pt. ii. 159. — Koch, *Dendr.* ii. 468. — Emerson, *Trees Mass.* ed. 2, i. 261, t. — Schnizlein, *Icon.* t. 97, f. 1–24. — Mathieu, *Flore Forestière*, ed. 3, 376. — Lauche, *Deutsche Dendr.* 354, f. 137. — Sargent, *Forest Trees N. Am.* 10*th Census U. S.* ix. 129. — Watson & Coulter, *Gray's Man.* ed. 6, 467. — Jankó, *Bot. Jahrb.* xi. 450. — Coulter, *Contrib. U. S. Nat. Herb.* ii. 410 (*Man. Pl. W. Texas*). — Niedenzu, *Engler & Prantl Pflanzenfam.* iii. pt. ii. f. 76. — Koehne, *Deutsche Dendr.* 206, f. 40, A. — Dippel, *Handb. Laubholzk.* iii. 279, f. 152.

Platanus lobata, Moench, *Meth.* 358 (1794).

Platanus hybridus, Brotero, *Fl. Lus.* ii. 487 (1804).

Platanus vulgaris, ϵ **angulosa**, Spach, *Ann. Sci. Nat.* sér. 2, xv. 293 (1841); *Hist. Vég.* xi. 79. — Bommer, *Les Platanes et leur Culture*, 17.

Platanus occidentalis, var. **Hispanica**, Wesmael, *Mém. Soc. Sci. Hainaut*, sér. 3, i. 12, f. 5 (1867). — Koehne, *Deutsche Dendr.* 206.

Platanus occidentalis, β **lobata**, Bommer, *Les Platanes et leur Culture*, 17, f. 5, 6 (1869).

A tree, occasionally one hundred and forty to one hundred and seventy feet in height, with a trunk sometimes ten or eleven feet in diameter above its abruptly enlarged base, often divided near the ground into several large secondary trunks, or rising seventy or eighty feet as a straight column-like shaft free from branches and with little diminution of diameter;[1] and massive spreading limbs which form a broad open rather irregular head often exceeding a hundred feet in diameter, their extremities usually erect or sometimes more or less pendulous. The bark at the base of large trunks is two to three inches thick, dark brown, and divided by deep furrows into broad rounded ridges separating on the surface into small thin appressed scales; thickest near the ground, it gradually grows thinner, and passes into the bark of the younger trunks and large branches, which rarely exceeds half an inch in thickness, and is dark reddish brown, and broken into small oblong thick appressed plate-like scales, while high on the tree it is smooth and light gray, and separates into large thin scales, which, in falling, expose large irregular surfaces of the pale yellow, whitish, or greenish inner bark. The branchlets are at first coated, like the leaves, the petioles, and stipules, with thick pale tomentum, which soon disappears; during their first summer they are dark green and glabrous, and marked with many minute oblong pale lenticels, and during their first winter they are dark orange-brown and rather lustrous, becoming light gray in their second year or light reddish brown when they cast their pale membranous outer bark. The leaves are broadly ovate, more or less deeply three to five-lobed by broad shallow sinuses rounded in the bottom, the lobes being broad, acuminate, sinuate-toothed with long straight or

[1] The large trunks of *Platanus occidentalis* are usually hollow to a considerable height above the ground.

curved remote acuminate teeth, or entire, with undulate margins; they are truncate or slightly cordate, or wedge-shaped and decurrent on the petioles at the base, with stout yellow ribs and veins, thin and firm, bright green on the upper surface, paler on the lower, and glabrous, with the exception of a coating of pale pubescence along the ribs and principal veins, and are four to seven inches in length and breadth, or twice as large on vigorous shoots, when they are frequently furnished with dentate basal lobes; they are borne on stout terete or slightly angled puberulous petioles covered with pale pubescence. The stipules are an inch to an inch and a half long and entire or sinuate-toothed. The peduncles are coated with pale tomentum, and generally bear one and sometimes two heads of flowers. The heads of fruit, which are usually solitary or rarely spicate, are an inch in diameter, and hang on slender glabrous stems three to six inches long. The akenes are about two thirds of an inch in length, and are truncate or obtusely rounded at the apex.

Platanus occidentalis inhabits the borders of streams and lakes and rich bottom-lands, and ranges from southeastern New Hampshire and southern Maine to northern Vermont and the valley of the Don near the northern shores of Lake Ontario,[1] westward to eastern Nebraska[2] and Kansas, and southward to northern Florida, central Alabama and Mississippi, and the valley of the Brazos River in Texas, and thence southwestward in Texas to the Devil's River valley. A common tree in all this region, it is most abundant and grows to its largest size on the bottom-lands of the basins of the lower Ohio and of the Mississippi Rivers.[3]

The specific gravity of the absolutely dry wood of *Platanus occidentalis* is 0.5678, a cubic foot weighing 35.39 pounds. It is largely used and is the favorite material for the boxes in which tobacco is packed, for ox-yokes, and butchers' blocks, and for furniture and the interior finish of houses, where its broad conspicuous medullary rays and cheerful color make it valuable.

Platanus occidentalis was introduced into English gardens by the younger Tradescant early in the seventeenth century,[4] and the first account of it, published in 1640 in Parkinson's *Theatrum Botanicum*,[5] relates to a tree cultivated in England. It is now occasionally planted in American and European[6] parks and avenues, although as an ornamental tree its value is impaired by the fungal disease which strips it of its young leaves in spring, and stunts and often deforms its growth.

Always conspicuous from the pale often mottled bark which covers the upper parts of the trunk and branches, the Sycamore,[7] which is the most massive if not the tallest deciduous-leaved tree of the North American forest, is a magnificent object as it grows in the deep alluvial soil of the bottom-lands of the Mississippi basin, with its long ponderous branches and its broad leafy crown of bright green cheerful foliage raised high above the heads of its sylvan associates.

[1] Brunet, *Cat. Vég. Lig. Can.* 45. — Macoun, *Cat. Can. Pl.* 432.

[2] Bessey, *Rep. Nebraska State Board Agric.* 1894, 105.

[3] Ridgway, *Proc. U. S. Nat. Mus.* 1882, 73.

[4] Aiton, *Hort. Kew.* iii. 365. — Loudon, *Arb. Brit.* iv. 2043, f. 1959, 1960.

[5] *Platanus occidentalis aut Virginiensis*, 1427. — Boerhaave, *Ind. Alt. Hort. Lugd. Bat.* ii. 209.

Platanus Novi Orbis, foliis Vespertilionum alas referentibus, globulis parvis, Plukenet, *Alm. Bot.* 300.

Platanus occidentalis, Catesby, *Nat. Hist. Car.* i. 56, t. 56.

Platanus foliis lobatis, Linnæus, *Hort. Cliff.* 447. — Royen, *Fl. Leyd. Prodr.* 78. — Clayton, *Fl. Virgin.* ed. 2, 151.

Cephalanthus capitulis pendulis, Colden, *Act. Hort. Ups.* 1743, 85 (*Pl. Novebor.*).

[6] It is frequently stated that *Platanus occidentalis* is common in European plantations; but, so far as I have been able to observe, it is now exceedingly rare in western and central Europe, where I have seen only a few individuals.

[7] *Platanus occidentalis* is also sometimes called Button-ball tree and Water Beech. In Europe, Sycamore, the common name of the different Plane-trees in the United States, is always applied to *Acer Pseudo-Platanus*, and never to the Plane, while the Sycomorus of the ancients is the *Ficus Sycomorus* of northeastern Africa. (See *Garden and Forest*, ii. 349.)

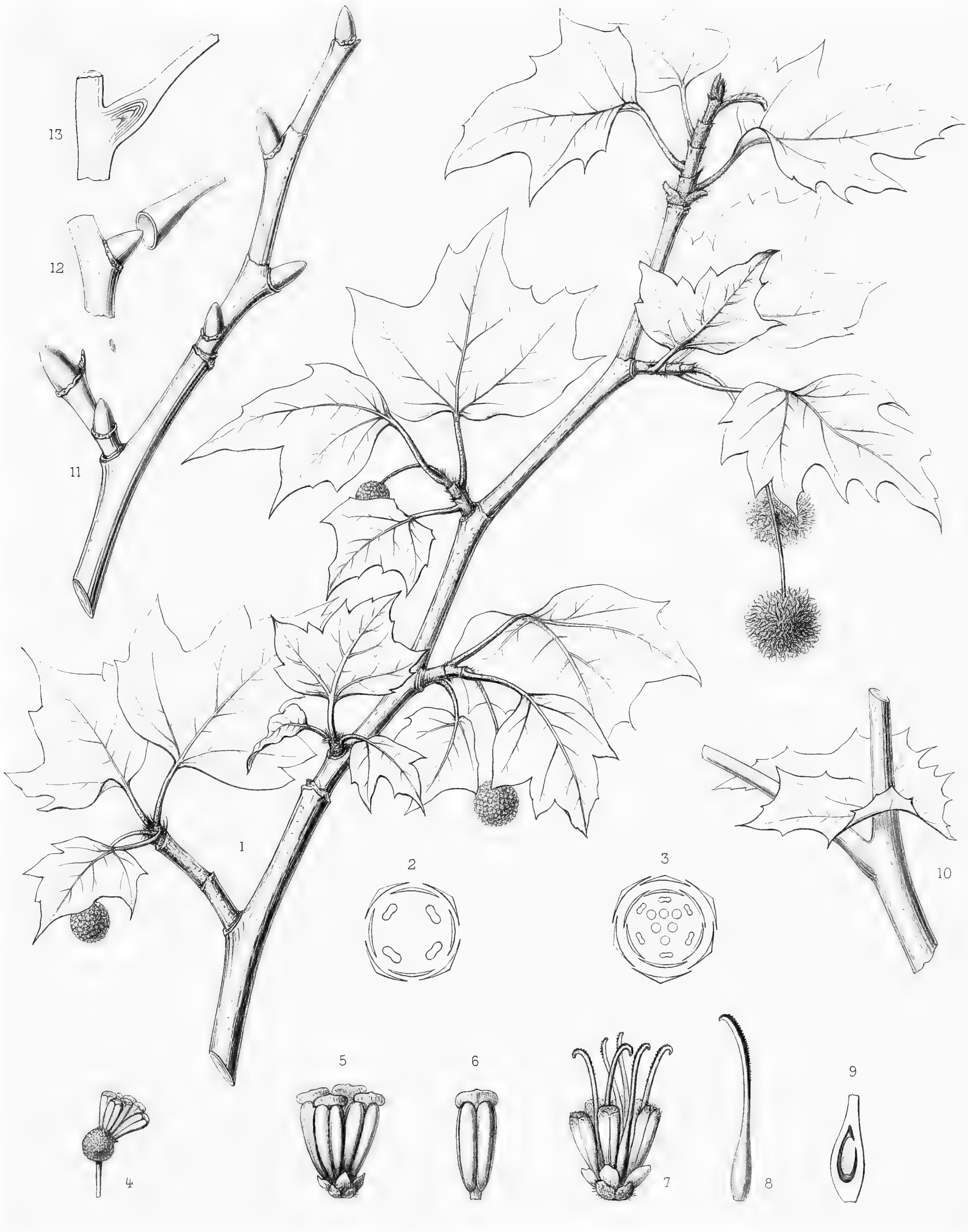
EXPLANATION OF THE PLATES.

Plate CCCXXVI. Platanus occidentalis.

1. A flowering branch, natural size.
2. Diagram of a staminate flower.
3. Diagram of a pistillate flower.
4. A head of staminate flowers with most of the flowers removed, enlarged.
5. A staminate flower, enlarged.
6. A stamen, enlarged.
7. A pistillate flower, enlarged.
8. A pistil, enlarged.
9. Vertical section of an ovary, enlarged.
10. Portion of a branch and stipule, natural size.
11. A winter branchlet, natural size.
12. Portion of a branchlet showing bud and the base of a petiole, natural size.
13. Vertical section of a branchlet, bud and petiole, natural size.

Plate CCCXXVII. Platanus occidentalis.

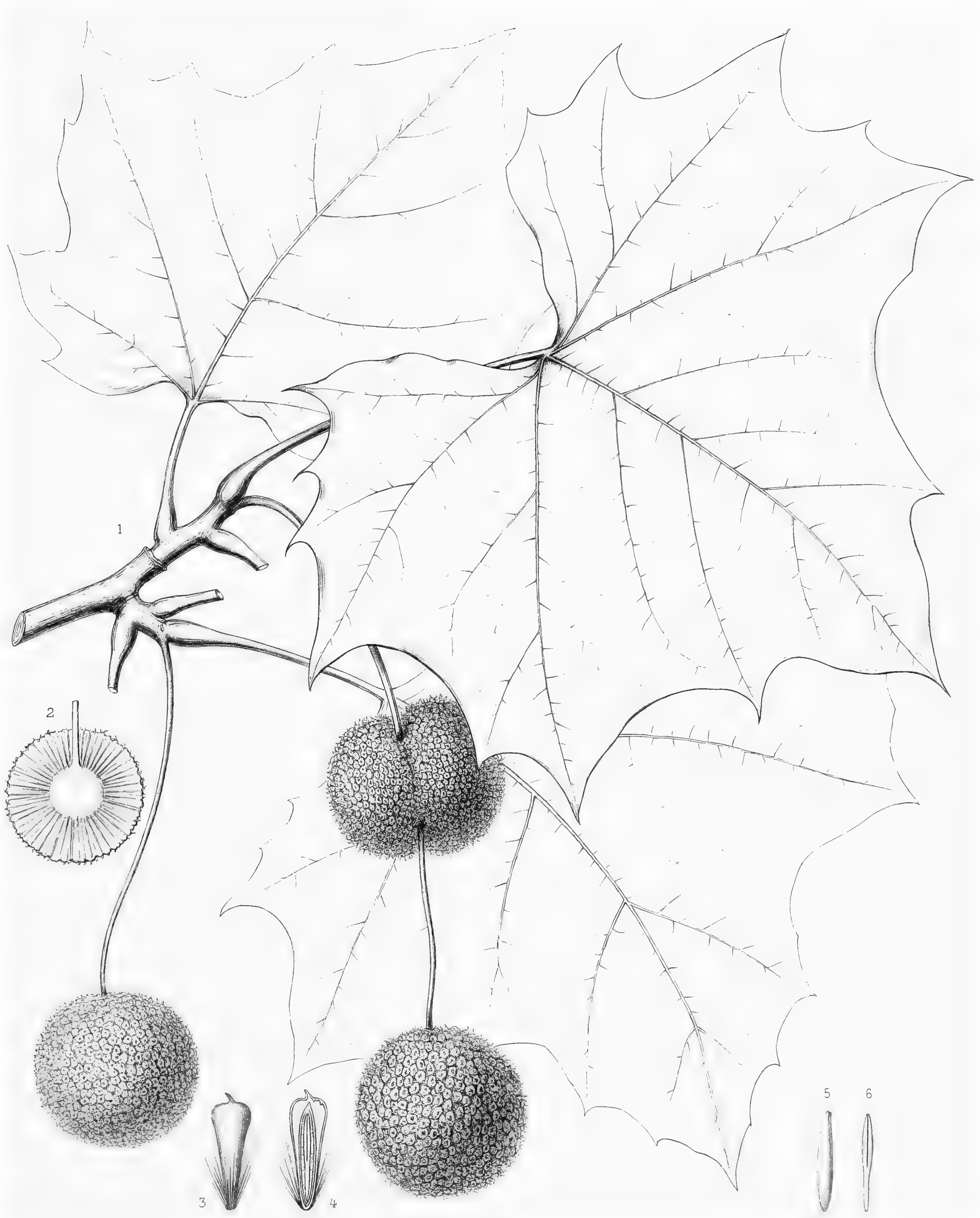
1. A fruiting branch, natural size.
2. Vertical section of a head of fruit, natural size.
3. An akene, enlarged.
4. Vertical section of an akene, enlarged.
5. A seed, enlarged.
6. An embryo, enlarged.



C.E. Faxon del. Rapine sc.

PLATANUS OCCIDENTALIS, L.

A. Riocreux direx.t Imp. J. Taneur, Paris.



C.E. Faxon del. Rapine sc.

PLATANUS OCCIDENTALIS, L.

A. Riocreux direx.t Imp J Taneur, Paris.

PLATANUS RACEMOSA.

Sycamore.

LEAVES deeply 3 to 5-lobed, the lobes entire, remotely and obscurely dentate or rarely sinuate-toothed, truncate or rarely slightly cordate or wedge-shaped at the base. Fruit racemose.

Platanus racemosa, Nuttall, *Sylva*, i. 47, t. 15 (1842). — Audubon, *Birds*, t. 362. — Bentham, *Pl. Hartweg.* 336. — Newberry, *Pacific R. R. Rep.* vi. 33, 89, t. 2, f. 10. — Torrey, *Bot. Mex. Bound. Surv.* 204; *Ives' Rep.* 27; *Bot. Wilkes Explor. Exped.* 457. — A. de Candolle, *Prodr.* xvi. pt. ii. 160. — Koch, *Dendr.* ii. 469. — Brewer & Watson, *Bot. Cal.* ii. 66. — Sargent, *Forest Trees N. Am. 10th Census U. S.* ix. 129. — Jankó, *Bot. Jahrb.* xi. 451. — Koehne, *Deutsche Dendr.* 206. — Dippel, *Handb. Laubholzk.* iii. 278, f. 151. — Greene, *Man. Bay Region Bot.* 297. — Coville, *Contrib. U. S. Nat. Herb.* iv. 195 (*Bot. Death Valley Exped.*).

Platanus occidentalis, Hooker & Arnott, *Bot. Voy. Beechey*, 160, 390 (not Linnæus) (1833).

Platanus Californica, Bentham, *Bot. Voy. Sulphur*, 54 (1844).

Platanus Mexicana, Torrey, *Sitgreaves' Rep.* 172 (not Moricand) (1853); *Pacific R. R. Rep.* vii. pt. iii. 20.

A tree, sometimes one hundred to one hundred and twenty feet in height, with a trunk occasionally nine feet in diameter above the broad tapering base, sometimes erect and free of branches for half its height, more often dividing near the ground into several secondary stems which are erect, inclining, or prostrate for twenty to thirty feet at their base, and thick ponderous more or less contorted long spreading branches which form an open irregular round-topped head; usually smaller and generally seventy to eighty feet in height, with a trunk two to three feet in diameter. The bark at the base of the trunks of old individuals is three to four inches thick, dark brown, deeply furrowed, with broad rounded ridges separating on the surface into thin scales; higher on the trunk and on the branches it is thinner, smooth, and pale or almost white. The branches, which are coated at first with thick pale tomentum, which soon disappears, during their first winter are light reddish brown and marked with numerous small lenticels, and gradually grow darker in their second and third years. The leaves are three or five-lobed to below the middle, with acute or acuminate lobes, which are entire, dentate with remote minute callous-tipped teeth, or occasionally coarsely sinuate-toothed, and broad sinuses acute or rounded in the bottom; they are usually cordate or sometimes truncate, or wedge-shaped and decurrent at the base on the petioles, six to ten inches in length and breadth, thick and firm, light green on the upper surface, and on the lower surface paler and more or less thickly coated with pale pubescence, which is most abundant along the broad midribs and primary veins; they are borne on stout pubescent petioles one to three inches long, and often do not all fall until spring. The stipules are an inch to an inch and a half in length, and entire or dentate. The peduncles are covered with pale pubescence, and usually bear four or five heads of staminate flowers or from two to seven heads of pistillate flowers, a head of staminate flowers occasionally appearing on the pistillate peduncle above the fertile heads. The heads of fruit hang on slender zigzag glabrous or pubescent stems six to ten inches in length, and are three quarters of an inch in diameter. The akene is acute or rounded at the apex, one third of an inch long, tomentose while young and glabrous at maturity.

Platanus racemosa is distributed from the valley of the lower Sacramento River in California southward through the interior valleys and coast ranges of the state, finding its southern home on San Pedro Martir Mountain in Lower California.[1] It inhabits the banks of streams, and is exceedingly common in all the valleys of the coast range from Monterey to the southern borders of the state,

[1] Brandegee, *Zoë*, iv. 209.

ascending the southern slopes of the San Bernadino Mountains to an elevation of three thousand feet above the level of the sea.[1]

The specific gravity of the absolutely dry wood of *Platanus racemosa* is 0.4880, a cubic foot weighing 30.41 pounds.

Confounded with the Plane-tree of the eastern United States by the botanists who first explored the coast of southern California, *Platanus racemosa*, which is one of the noblest and most beautiful deciduous-leaved trees of the Pacific forests, was first distinguished by Thomas Nuttall, who found it at Santa Barbara in 1835.

[1] S. B. Parish, *Zoë*, iv. 344.

EXPLANATION OF THE PLATE.

Plate CCCXXVIII. Platanus racemosa.

1. A flowering branch, natural size.
2. A stamen, enlarged.
3. A pistil, enlarged.
4. A fruiting branch, natural size.
5. Vertical section of an akene, enlarged.
6. An embryo, enlarged.
7. A leaf, natural size.
8. A winter branchlet, natural size.

C.E. Faxon del. Rapine sc.

PLATANUS RACEMOSA, Nutt.

A. Riocreux direx.t Imp J. Taneur, Paris

PLATANUS WRIGHTII.

Sycamore.

LEAVES deeply 3 to 7-lobed, the lobes elongated, slender, entire or rarely remotely dentate, usually deeply cordate or rarely wedge-shaped at the base. Fruit racemose.

Platanus Wrightii, Watson, *Proc. Am. Acad.* x. 349 (1875). — Rusby, *Bull. Torrey Bot. Club*, ix. 54. — Sargent, *Forest Trees N. Am. 10th Census U. S.* ix. 130. — Coulter, *Contrib. U. S. Nat. Herb.* ii. 410 (*Man. Pl. W. Texas*).

Platanus Mexicana, Torrey, *Emory's Rep.* 151 (not Moricand) (1848).

Platanus racemosa, Watson, *Pl. Wheeler*, 16 (not Nuttall) (1874). — Rothrock, *Wheeler's Rep.* vi. 239.

A tree, often sixty to eighty feet in height, with a straight trunk four or five feet in diameter at the base, gradually tapering and free from branches for twenty or thirty feet, or with a trunk dividing just above the surface of the ground into two or three large stems, usually more or less reclining, and often nearly prostrate for fifteen or twenty feet, and with thick contorted branches; of these the lowest frequently grow almost at right angles to the trunk, and are fifty or sixty feet in length, while the upper are usually erect at first, and then spread into a broad open handsome head. The base of the trunk is covered with dark bark three or four inches thick, deeply and irregularly divided into broad ridges, and covered on the surface with small appressed scales; ten or fifteen feet above the ground it grows thinner, separating into larger scales, and gradually passes into the bark of the upper trunk and branches, which is smooth, much thinner, and creamy white faintly tinged with green. The branchlets are slender, and are coated at first with thick pale tomentum, which soon begins to disappear; during their first winter they are glabrous or slightly puberulous, marked with minute scattered lenticels, and light brown tinged with red, or ashy gray, and gradually grow darker during their second and third years. The leaves are divided by narrow sinuses to below the middle, and sometimes nearly to the centre into three to seven, but usually into five, elongated acute lobes, which are entire, or dentate with callous-tipped teeth, or occasionally are furnished with one or two acuminate lateral lobes; they are sometimes deeply cordate by the downward projection of the lower lobes or are often truncate or wedge-shaped at the base; they are six to eight inches in length and breadth, thin and firm in texture, light green and glabrous above and coated with pale pubescence below, with narrow ribs and primary veins connected by rather conspicuous reticulate veinlets, and stout glabrous or puberulous petioles an inch and a half to three inches long. The peduncles are clothed with thick white tomentum, and bear two to four heads of flowers. The heads of fruit hang on slender glabrous stems six to eight inches in length, and are about three quarters of an inch in diameter. The akenes are glabrous, about one quarter of an inch long and truncate at the apex.

Platanus Wrightii inhabits the banks of streams in the mountain cañons of southwestern New Mexico, southern Arizona, and Sonora; on all the mountain ranges in New Mexico and Arizona, south of the high Colorado plateau, it is the largest and one of the most abundant of the deciduous-leaved trees, extending from the mouths of the cañons up to elevations of from five to six thousand feet above the level of the sea.

The specific gravity of the absolutely dry wood is 0.4736, a cubic foot weighing 29.51 pounds.

Platanus Wrightii was discovered in 1851 by Mr. Charles Wright[1] in southern Arizona during

[1] See i. 94.

his connection with the United States and Mexican Boundary Survey. Originally confounded with *Platanus racemosa*, it was first distinguished by Sereno Watson.[1]

In the deep and sombre cañons of the Arizona mountains, *Platanus Wrightii* is a noble and beautiful object, rising high above the Walnuts, Willows, and Alders which mark the course of the streams, with its great wide-spreading pale sea-green branches and bright foliage thrown into clear relief against the sunburnt hills covered with dark Evergreen Oaks and darker Pines.

[1] Sereno Watson (1826–92) was born at Windsor Hill, Connecticut, and was graduated from Yale College in 1847; having taught school in different states, he studied medicine in the University of New York and later with an elder brother established at Quincy, Illinois. He practiced his profession during two years only, and then abandoned it to assume a business position in Alabama, where he resided from 1856 to 1861, beginning at this time the study of plants, although it was not until several years later, after a term in the Sheffield Scientific School, that he became a professional botanist.

In 1868 Dr. Watson was appointed botanist of the United States Geological Expedition which, under the leadership of Clarence King, explored the territory west of the Rocky Mountains adjacent to the fortieth parallel of latitude. In 1871 he published, with the aid of Professor D. C. Eaton, his classical report upon the plants he had collected on this expedition; this led to his receiving the appointment at Cambridge of assistant to Professor Asa Gray, whom he succeeded as curator of the Gray Herbarium of Harvard College. He devoted the remainder of his life to a study of the flora of North America and to the care and development of the collections in his charge. In connection with Professor William H. Brewer, Dr. Watson prepared the botanical portion of the report of the Geological Survey of California; he was the author of a *Biographical Index of North American Botany*, issued in 1878, which unfortunately was not carried beyond the first volume, and of numerous papers published in the *Proceedings of the American Academy of Arts and Sciences*, in which some twelve hundred species of North American plants were first described by him, and many difficult groups were elaborated. In 1890, with Professor J. M. Coulter, he published an enlarged edition of Gray's *Manual of the Botany of the Northern United States*.

Serenoa, a genus of plants of the southern United States, established by the younger Hooker, commemorates the name of this modest and learned man, whose life was devoted to useful labor and noble endeavor.

EXPLANATION OF THE PLATE.

PLATE CCCXXIX. PLATANUS WRIGHTII.

1. A flowering branch, natural size.
2. A stamen, enlarged.
3. A pistil, enlarged.
4. A fruiting branch, natural size.
5. Vertical section of an akene, enlarged.
6. A seed, enlarged.
7. An embryo, enlarged.
8. A winter branchlet, natural size.

C.E.Faxon del. *Himely sc.*

PLATANUS WRIGHTII, Watson.

A.Riocreux direx.t *Imp. J.Taneur, Paris.*

LEITNERIA.

Flowers amentaceous, diœcious; perianth of the staminate flower 0; stamens 3 to 12; perianth of the pistillate flower minute; ovary 1-celled; ovule solitary, ascending. Fruit an oblong compressed drupe. Leaves alternate, entire, petiolate, destitute of stipules, deciduous.

Leitneria, Chapman, *Fl.* 427 (1860). — Baillon, *Hist. Pl.* vi. 239, f. 214–216. — Bentham & Hooker, *Gen.* iii. 397. — Engler, *Engler & Prantl Pflanzenfam.* iii. pt. i. 29, f. 22.

A shrub or tree, with pale slightly fissured bark, scaly buds, stout terete pithy branchlets marked with pale conspicuous elevated nearly circular lenticels and with elevated crescent-shaped obliquely angled or sometimes obscurely three-lobed leaf-scars displaying the ends of three conspicuous fibro-vascular bundle-scars, and thick fleshy stoloniferous yellow roots spreading horizontally near the surface of the ground. Terminal buds broad, conical, an eighth of an inch long, covered by ten or twelve oblong triangular closely imbricated scales coated with pale tomentum, often persistent during one or two years at the base of the branch, and in falling marking it with narrow ring-like scars; lateral leaf-buds smaller, ovoid, flattened by the pressure of the stem. Leaves involute in vernation, lanceolate to elliptical-lanceolate, acuminate or acute and short-pointed at the apex, gradually narrowed at the base, entire, with slightly thickened revolute undulate margins, penniveined, with remote primary veins arcuate and united near the margins, and connected by conspicuous reticulate veinlets, long-petiolate, the stout petioles grooved on the upper side; as they unfold coated on the lower surface and on the petioles with thick pale tomentum, and puberulous on the upper surface; at maturity thick and firm, bright green and lustrous above, pale and coated below and on the broad midribs and veins with villous pubescence, deciduous. Flowers amentaceous, expanding in early spring with the first unfolding of the leaves from inflorescence-buds developed the previous autumn in the axils of leaves of the year and covered with many imbricated ovate acute concave chestnut-brown scales coated on the outer surface with pale hairs, the lowest often persistent after anthesis. Sterile aments clustered near the ends of the branches, frequently excurved at maturity, composed of numerous ovate acute concave bracts, inserted on a stout pubescent rachis and bearing on their torus-like stalks a ring of three to twelve stamens; filaments slender, somewhat dilated at the base, incurved; anthers oblong, slightly emarginate, attached on the back below the middle, bright yellow, introrse, two-celled, the cells opening longitudinally; pollen grains glabrous, slightly three to four-grooved. Pistillate aments scattered, shorter and more slender than those of the staminate plant, composed of imbricated ovate acute concave bracts, bearing in their axils a short-stalked pistil surrounded by a rudimentary perianth of small gland-fringed scales, the two largest lateral, the others next the axis of the inflorescence. Ovary one-celled, ovoid, pubescent, crowned with an elongated flattened style, inserted obliquely, curving above the middle outward in anthesis, grooved and stigmatic on the outer face; ovule solitary, attached laterally to a placenta facing the bract, ascending, semianatropous, the micropyle directed upward. Fruit ovate, thick and rounded on the ventral, narrowed on the dorsal edge, rounded at the base, compressed and pointed at the apex, marked by the pale oblique scar left by the falling of the deciduous style, chestnut-brown, rugose; exocarp thick and dry, closely investing the thin-walled light brown crustaceous rugose nutlet.

Seed filling the cavity of the nutlet, compressed, rounded at both ends, marked on the thick edge with an oblong nearly black hilum. Embryo erect, surrounded by thin fleshy albumen; cotyledons oblong, flattened, rounded at the extremities; radicle superior, conical, short, and fleshy.

The wood of Leitneria is soft, exceedingly light, close-grained, and contains thin obscure medullary rays and groups of small open ducts, the layers of annual growth, which are not distinguishable to the naked eye, being marked by narrow bands of interrupted cells; it is pale yellow, and shows no trace of heartwood. The specific gravity of the absolutely dry wood is 0.2070,[1] a cubic foot weighing 12.90 pounds. It is used for the floats of fishing-nets in Missouri, its remarkable lightness[2] making it valuable for this purpose.

Leitneria was discovered by Thomas Drummond;[3] it was found by Dr. A. W. Chapman[4] in 1847 growing on the muddy shores of a cove washed by high tides five miles west of the town of Apalachicola in Florida; and in October, 1892, by Mr. B. F. Bush[5] in the deep swamps bordering the St. Francis River in southeastern Missouri.

The generic name commemorates that of a German naturalist killed in Florida during the Seminole War.

The genus is represented by a single species.

[1] This determination made by Professor Nipher is published in Professor William Trelease's exhaustive study of Leitneria, to which I am indebted for my knowledge of this interesting tree. (See *Rep. Missouri Bot. Gard.* vi. t. 30–44.)

[2] The wood of no other North American tree that has been examined is as light as that of Leitneria; the wood which approaches it nearest in lightness is that of the Florida *Ficus aurea*, which has a specific gravity of 0.2616.

[3] See ii. 25.

Drummond's specimen preserved in the herbarium of the Royal Gardens at Kew has no collector's ticket, and is labeled in the handwriting of Sir William Hooker, "Rio Brazos, Texas." Drummond passed some time in Apalachicola, where he made a large collection of plants, and it is not impossible that it was in Florida and not in Texas, where it has not been seen since, that he discovered Leitneria.

[4] Alvan Wentworth Chapman (September 28, 1809) was born in Southampton, Massachusetts, and was graduated from Amherst College in 1830. Having taught school in different parts of Georgia from 1831 to 1834, he studied medicine at Washington, Georgia, and then with Dr. John W. Davidson at Quincy, Florida. In 1846, having received an honorary degree of Doctor of Medicine from the Louisville Medical Institute, he established himself in Apalachicola, Florida, which is still his home. Before leaving Massachusetts, Dr. Chapman had acquired a fondness for botany and some rudimentary knowledge of the science, although his botanical career did not begin until after his settlement in Florida, when he commenced, in his long professional rides, the systematic formation of a herbarium upon which was based his *Flora of the Southern United States*, prepared in the moments of leisure left by the demands of a laborious profession, and published in 1860, with a second edition and appendix in 1883.

Chapmannia, a Florida herb of the Pea family, commemorates his successful botanical labors.

[5] Benjamin Franklin Bush was born in Columbus, Indiana, in 1858, and in 1865 moved to Independence, Missouri, where he has been engaged in horticultural pursuits. In 1892 Mr. Bush prepared a herbarium of the dried plants of Missouri and a collection of the forest products of the state for the Columbian Exposition held in Chicago in the summer of 1893. His *Notes on a List of Plants collected in Southeastern Missouri* are published in the *Report of the Missouri Botanic Garden*, v. 139.

LEITNERIA FLORIDANA.

Cork Wood.

Leitneria Floridana, Chapman, *Fl.* 428 (1860). — C. de Candolle, *Prodr.* xvi. pt. ii. 154. — Oliver, *Hooker Icon.* ser. 3, i. 33, t. 1044. — Bush, *Rep. Missouri Bot. Gard.* v. 150.

A shrub or small tree, occasionally twenty feet in height, with a straight slender trunk four or five inches in diameter above the swollen gradually tapering base, and spreading branches which form a loose open head. The bark of the trunk is about one sixteenth of an inch thick, dark gray faintly tinged with brown, and divided by shallow fissures into narrow rounded ridges. The branchlets, when they first appear, are light, rather reddish-brown, and thickly coated with thick hairs, which gradually disappear, and during their first winter they are glabrous or puberulous, especially toward the extremities, and dark red-brown. The leaves are four to six inches long and an inch and a half to two and a half inches wide, and are borne on petioles which vary from one to two inches in length. The aments of staminate flowers are an inch to an inch and a quarter long, and one quarter of an inch thick, and twice as long as those of the pistillate flowers. The flowers open at the end of February or early in March; and the fruit, which is solitary or in clusters of two to four, and ripens when the leaves are about half grown, is three quarters of an inch long and one quarter of an inch wide.

Leitneria Floridana inhabits muddy saline shores on the coast of the Gulf of Mexico near Apalachicola, Florida, where it is known only in a few isolated stations; and deep swamps inundated during several months of the year in Butler and Duncan Counties, Missouri, where it is abundant, growing with *Taxodium distichum*, *Acer rubrum*, *Nyssa aquatica*, and *Planera aquatica*, in rich moist soil usually covered with water often two or three feet deep, and sometimes occupying muddy sloughs of considerable extent to the exclusion of other woody plants.[1]

[1] "Apparently suckers arise from some of the roots, as in the case with the Ailanthus and White Poplar; but I have not been able to actually trace these young shoots to the older plants, though their root system is usually developed out of proportion to their size. The impression made on one by such a Leitneria swamp is that of a tangle of coarse bushes from five to ten feet in height, but on closer observation it is evident that each stem rises separately from the soil or water, so that the plant lacks the clustered bushy habit which distinguishes a shrub from a small tree, and it not infrequently attains a height of fifteen or twenty feet and forms a trunk from three to five inches thick toward the base, where it gradually increases in thickness as do many other swamp trees." (Trelease, *Rep. Missouri Bot. Gard.* vi.)

EXPLANATION OF THE PLATE.

Plate CCCXXX. Leitneria Floridana.

1. A flowering branch of a staminate plant, natural size.
2. A flowering branch of a pistillate plant, natural size.
3. A bract of the staminate ament, exterior view, enlarged.
4. A staminate flower with bract, enlarged.
5. Rear and front views of a stamen, enlarged.
6. A pistillate flower with bract and involucre, the style cut transversely, enlarged.
7. Vertical section of a staminate flower with bract, enlarged.
8. A fruiting branch, natural size.
9. Vertical section of a fruit, enlarged.
10. Cross section of a fruit, enlarged.
11. A stone, natural size.
12. A seed, enlarged.
13. An embryo, enlarged.
14. A leafy branch, natural size.
15. A winter branchlet of the staminate plant, natural size.
16. A winter branchlet of the pistillate plant, natural size.
17. An axillary bud and leaf-scar, enlarged.

C.E.Faxon del. Toulet sc.

LEITNERIA FLORIDANA, Chapm.

A Riocreux direx.t Imp. J. Taneur, Paris.

JUGLANS.

Flowers monœcious, apetalous; calyx of the staminate flower 3 to 6-lobed, the lobes imbricated in æstivation; stamens 8 to 40; calyx of the pistillate flower 4-lobed, the lobes imbricated in æstivation; ovary inferior, 1-celled; ovule solitary, erect. Fruit, a nut inclosed in an indehiscent involucre. Leaves alternate, unequally pinnate, destitute of stipules, deciduous.

Juglans, Linnæus, *Gen.* 291 (1737). — A. L. de Jussieu, *Gen.* 375. — Meisner, *Gen.* pt. ii. 54. — Endlicher, *Gen.* 1126. — Bentham & Hooker, *Gen.* iii. 398. — Engler, *Engler & Prantl Pflanzenfam.* iii. pt. i. 24. — Baillon, *Hist. Pl.* xi. 405.

Wallia, Alefeld, *Bonplandia*, ix. 334 (1861).

Resinous aromatic trees, with sweet watery juice, furrowed scaly bark, handsome durable dark-colored wood, stout terete branchlets, laminate pith, scaly buds, long stout flexible perpendicular roots covered with thick bark, and few thick fibrous rootlets. Terminal buds short or elongated, usually covered with two pairs of opposite scales often obscurely pinnate at the apex, those of the inner pair accrescent, more or less leaf-like, often resembling the short-lived scale-like upper leaves, and in falling marking the base of the branchlet with faint ring-like scars. Axillary buds formed before midsummer, obtuse, slightly flattened, covered with four ovate rounded scales, superposed, two to four together, decreasing in size from the upper to the lower, the scales closed or open during winter. Leaves alternate, unequally pinnate or often equally pinnate by the suppression of the terminal leaflet, many-foliolate, deciduous, the last leaf of the year sometimes reduced to a scale-like body and persistent during the winter; petioles elongated, terete, grooved on the upper side, gradually enlarged toward the base, leaving in falling large conspicuous elevated obcordate three-lobed leaf-scars displaying three equidistant U-shaped clusters of dark fibro-vascular bundle-scars, the basal cluster much larger than the others; leaflets conduplicate in vernation, ovate, acute or acuminate, mostly unequal at the base, membranaceous, serrate or entire, sessile or short-petiolulate, or the terminal leaflet raised on a long slender stalk, penniveined, the veins arcuate and united near the margins and connected by reticulate veinlets, often separating from the petiole in falling. Flowers proterandrous or proterogynous, opening in the late spring after the leaves. The staminate in many-flowered elongated aments, solitary or in pairs from the lower axillary buds of the upper nodes, appearing from between the persistent bud-scales in the autumn and remaining during the winter as short cones covered by the closely imbricated bracts of the flowers, coated with tomentum, and beginning to elongate in early spring. Perianth sessile or pedicellate, three to six-lobed in the axil of and adnate to an ovate acute bract free only at the apex. Stamens eight to forty, inserted on the perianth in two or several ranks, those of the exterior rank alternate with its lobes; filaments free, abbreviated; anthers erect, oblong, glabrous, two-celled, the cells opening longitudinally and surmounted by a conspicuous dilated truncate or lobed connective. Ovary wanting. Pistillate flowers in few-flowered spikes terminal on branches of the year, invested by a villous involucre adnate to the ovary and formed by the union of the anterior bract, sometimes free nearly to the base, and two lateral bractlets free only at the apex, and variously cut into a laciniate border shorter than the erect lanceolate calyx-lobes inserted on the summit of the ovary. Stamens wanting. Pistil composed of two median, or rarely of three, carpels; ovary inferior, one-celled; style short; stigmas

dorsal, linear or club-shaped, spreading, recurved, fimbriately plumose; ovule solitary, erect from the bottom of the cell, orthotropous. Fruit ovoid, globose or pyriform, cylindrical or obscurely four-angled, marked at the apex with the remnants of the style; involucre fleshy, indehiscent, glabrate or hirsute, adherent to the nut, or free at maturity and separating from it irregularly. Nut ovoid or globose, more or less flattened, hard, thick-walled, the walls and partitions often lacunose with irregular variously shaped internal longitudinal cavities filled with dry powder, longitudinally and irregularly rugose, separating by the dorsal sutures in germination into two, or rarely into three valves; the valves alternate with the cotyledons, sometimes furnished at the dorsal sutures, and in some species also at the marginal sutures, with broad thick ribs; the cavity imperfectly two-celled at the base by the development, at right angles with the valves, of a thin dissepiment from the bottom to above the middle, the cells sometimes subdivided by lower thicker partitions parallel with the valves, the apex of the cavity narrow and pointed by the thickening of the walls of the endocarp, broader and penetrated in some species by a short thick dissepiment parallel with the valves and deeply notched at the bottom. Seed solitary, filling the cavity of the nut, exalbuminous, compressed, two-lobed from the bottom to the middle, the lobes oblong, rounded or keeled on the back, concave on the inner face, rounded or deeply lobed at the base, gradually narrowed or broad and deeply lobed at the apex, and then abruptly contracted into a broad point flattened at right angles with the plane of the lobes; testa thin, membranaceous, of two coats, the outer light brown, marked with conspicuous darker veins radiating from the apex and from the minute basal hilum. Embryo fleshy, oily; radicle short, stout, superior, filling the apex of the cavity of the nut.

Juglans is now confined to the temperate and southern parts of North America, the Antilles, South America from Venezuela to Peru, the Caucasus, Persia and northwestern India, Manchuria, northern China, and Japan. About ten species are known;[1] two are widely distributed in the forests of eastern North

[1] Several supposed hybrids between different species of Juglans have appeared. In 1816, to commemorate the birth of his eldest son, Monsieur Pierre Phillipe André de Vilmorin, the distinguished horticulturist, planted in his garden at Verrières, near Paris, a seedling Walnut-tree which appears intermediate in character between *Juglans regia* and *Juglans nigra*, and has been described as *Juglans intermedia Vilmoriniana* (Carrière, *Rev. Hort.* 1863, 30. — Koch, *Dendr.* i. 588. — Dippel, *Handb. Laubholzk.* ii. 319). It is now a tree seventy-five to eighty feet in height, with a trunk three feet four inches in diameter at three feet above the surface of the ground, and stout erect slightly spreading branches; the character of the bark and buds appears intermediate between those of its supposed parents; the leaves resemble those of *Juglans regia*, although their leaflets are usually more numerous; the nut is smooth, globose, and an inch and a half in diameter, with the thick husk of *Juglans nigra;* in shape it resembles the nut of *Juglans regia*, but is thicker shelled and more deeply furrowed. The fruit of this tree, which is produced sparingly and not every year, is fertile and germinates freely, producing plants which resemble the parent, of whose origin nothing is known (M. L. de Vilmorin, *Garden and Forest*, iv. 51, f. 11, 12).

Another hybrid of supposed similar parentage and of unknown origin was described by Carrière as *Juglans intermedia pyriformis* (*l. c.* 28, f. 4–9. — Koch, *l. c.* — Dippel, *l. c.*); and still another hybrid of the same parentage, which is said to have originated in the garden of the Trianon at Versailles, is described by C. de Candolle as *Juglans regia intermedia* (*Ann. Sci. Nat.* sér. 4, xviii. 32, t. 4, f. 41–43).

A Walnut-tree, supposed to be a hybrid between *Juglans cinerea* and *Juglans nigra*, in the Botanic Garden of Marburg, has been described as *Juglans cinereo-nigra* (Muderoth, *Linnæa*, xxix. 728).

A Walnut-tree, found by Professor J. T. Rothrock growing in soil composed of sand and alluvial loam on the Rowe Farm on the north bank of the lower James River, in Virginia, and described by him in *Forest Leaves* (ii. 133, f.), has the habit, bark, and foliage of *Juglans regia*, and produces nuts which resemble those of *Juglans nigra* in shape, with thick hard shells and small kernels. Nothing is known of the history of this remarkable tree, which, in 1888, at six feet above the surface of the ground and above its greatly swollen base, had a trunk circumference of twenty-four feet eight inches, while its longest branch was sixty-seven feet in length. The nut of this tree has the appearance of hybrid origin, and resembles the nut of a Walnut-tree grown in France, and described by Carrière as *Juglans regia gibbosa* (*l. c.* 1860, 99, f. 21–23; 1861, 428, f. 101–103), which sprang from one of a number of nuts planted by a nurseryman at Fontenay-aux-Roses about 1848 and believed to have been received by him under the name of "Noix d'Amérique mangeables."

In eastern Massachusetts several Walnut-trees of unknown origin, in remote situations and isolated from each other, appear intermediate in character between *Juglans cinerea* and *Juglans regia*, and are probably hybrids of these species (Sargent, *Garden and Forest*, vii. 434, f. 69).

In California two interesting hybrid Walnuts have been produced through artificial fertilization by Mr. Luther Burbank of Santa Rosa. The first was obtained in 1874 by fertilizing the flowers of *Juglans regia* with the pollen of *Juglans Californica;* it is remarkable for the great size of its leaves and the vigor and rapidity of its growth. The nuts, which are produced very sparingly, resemble those of *Juglans regia* (Burbank, *New Creations in Fruits and Flowers*, 1893, 9, f.; 1894, 31, f.). Mr. Burbank's second hybrid was produced by fertilizing the flowers of *Juglans nigra* with the

America; one inhabits western Texas, New Mexico, and Arizona, ranging far south into Mexico, where one[1] and perhaps two other[2] species occur; and one inhabits the valleys of western California. The flora of the Antilles contains a single species of Juglans,[3] while two or perhaps three others occur in the northern and western countries of South America.[4] In the Old World the genus is represented by *Juglans regia*,[5] an inhabitant of southeastern Europe and western Asia and now cultivated in all temperate countries, by *Juglans Mandshurica*[6] of the Amour valley and northern China, and by *Juglans*

pollen of *Juglans Californica*. The foliage and habit of growth of this tree are intermediate between those of its parents; it produces fruit freely and precociously, and the nuts, resembling those of *Juglans nigra*, are said to be superior in quality to those of either of its parents, lacking the strong flavor of the nut of *Juglans nigra* and possessing the flavor and sweetness of those of the California species (Burbank, *New Creation in Fruits and Flowers*, 1893, 10, f.).

[1] *Juglans mollis*, Engelmann, *Hemsley Diag. Pl. Nov.* 54 (1880). — Hemsley, *Bot. Biol. Am. Cent.* iii. 163.

Juglans Mexicana, Watson, *Proc. Am. Acad.* xxvi. 152 (1891).

[2] *Juglans pyriformis*, Liebmann, *Vidensk. Medd. fra nat. For. Kjöbenh.* 1850, 79. — Walpers, *Ann.* iii. 844. — C. de Candolle, *Prodr.* xvi. pt. ii. 138. — Hemsley, *l. c.* 164.

Wallia pyriformis, Alefeld, *Bonplandia*, ix. 336 (1861).

[3] *Juglans insularis*, Grisebach, *Cat. Pl. Cub.* 68 (1866); *Kew Bull. Miscellaneous Information*, April, 1894, 138.

? Juglans cinerea, A. Richard, *Fl. Cub.* iii. 231 (not Linnæus) (1854).

[4] Little is known of the South American Walnuts. Dr. A. Ernst, director of the National Museum of Venezuela, describes the wood of a native species used in Caracas in cabinet-making, which he refers to *Juglans cinerea*, Linnæus (*La Exposicion Nacional de Venezuela en* 1883, 219). Fragmentary specimens of Walnut-trees have been collected in the United States of Colombia and in Bolivia (*Juglans nigra*, var. *Boliviana*, C. de Candolle, *Ann. Sci. Nat.* sér. 4, xviii. 33 (1862); *Prodr. l. c.* 137); and in the central region of Peru, about eleven degrees south of the equator, at elevations of from two thousand to four thousand feet above the level of the sea, a Walnut resembling *Juglans nigra* is said to be a conspicuous and valuable timber-tree. (See *Kew Bull. of Miscellaneous Information, l. c.* 140.)

[5] Linnæus, *Spec.* 997 (1753). — Duhamel, *Traité des Arbres Fruitiers*, nouv. éd. iii. t. 140, 141. — Alefeld, *l. c.* 336. — C. de Candolle, *Prodr. l. c.* 135. — Kurz, *Forest Fl. Brit. Burm.* ii. 490. — Boissier, *Fl. Orient.* iv. 1160. — Hooker f. *Fl. Brit. Ind.* v. 595.

Juglans regia, var. *Kamaonia*, C. de Candolle, *Ann. Sci. Nat. l. c.; Prodr. l. c.* 136.

Juglans regia, var. *Sinensis*, C. de Candolle, *Ann. Sci. Nat. l. c.* t. 4, f. 38, 39; *Prodr. l. c.* — Maximowicz, *Bull. Acad. Sci. St. Pétersbourg*, xvii. 57 (*Mél. Biol.* viii. 630).

? Juglans intermedia alata, Carrière, *Rev. Hort.* 1865, 446. — Dippel, *Laubholzk.* ii. 319.

? Juglans intermedia quadrangulata, Carrière, *l. c.* 1870–71, 493, f. 66–68.

Juglans regia, which is a large and lofty tree with stout spreading branches, is probably indigenous on the mountains of Greece, in Armenia, in the region south of the Caucasus and the Caspian Sea, on the northwestern and northern Himalayas, and in Burmah (A. de Candolle, *Origine des Plantes Cultivées*, 342). It was cultivated in northern India in very early times and carried thence to China, where it is still grown on a large scale (Bretschneider, *On the Value and Study of Chinese Botanical Works*, 16; *Early European Researches into the Flora of China*, 174). It is probably not indigenous, however, to China, nor is there any evidence that this tree is a native of Japan, as many authors have believed, although it is occasionally seen in that country in the neighborhood of human habitations. The Greeks cultivated a variety of this tree obtained from Persia; the Romans carried it to Italy, whence its cultivation as a fruit-tree has spread through all the countries of southern and western Europe, the Pacific states of North America, Chili, and other temperate regions. The nuts, which in the United States are usually called English walnuts, and are eaten fresh, sometimes before they are ripe, and frequently cured or pickled, form an important article of food in southern Europe and are consumed in all civilized countries. The nut of the wild tree is small, with a thick hard shell and small kernel, and is scarcely edible, but centuries of cultivation and careful selection have produced a number of forms with variously shaped thin-shelled nuts, which are propagated by grafting or budding (Loudon, *Arb. Brit.* iii. 1423. — Carrière, *l. c.* 1859, 147, f. 33; 1860, 539, f. 107, 607, f. 118; 1861, 425, f. 99, 100, 104, 105, 108; 1868, 455, f. 50; 1872, 119; 1878, 53, f. 10. — C. de Candolle, *Prodr. l. c.* 136).

In Europe and northern India Walnut-oil is pressed from the cotyledons, and is consumed in large quantities as a substitute for olive-oil in cooking, for illuminating, and for mixing with paint and varnish (Spons, *Encyclopædia of Industrial Arts, Manufactures, and Raw Commercial Products*, ii. 1413, 2024). The wood of this tree, which is tough, strong, moderately hard, and very durable, is light brown and often beautifully marked with darker shades; it does not warp or split easily, and can be made to receive a beautiful polish. The wood of no other tree is considered so valuable for gunstocks; in Europe it is largely used for this purpose and for furniture, and in Cashmere it is employed in turnery and is sometimes lacquered. The green husks of the nuts contain a yellow-brown coloring matter, and are used in dyeing cloth and to stain wood dark. In India the bark is used as a dye, in native medicine, and as a dentifrice; and the leaves and young branches serve as fodder for domestic animals (Brandis, *Forest Fl. Brit. Ind.* 498).

The husk of the nut has been employed in Europe as a vermifuge from the time of the ancients, and the oil of the nut was once believed to be efficacious against tape-worms. In France a bitter and astringent infusion of the leaves has been found effective in the treatment of scrofula (Roques, *Pl. Usuelles*, ed. 2, i. 264, t. 72, f. 242. — Hayne, *Arzn.* xiii. 17, t. 17). From the bitter outer coat of the seed a variety of tannic acid has been obtained, for which the name of nuci-tannin has been proposed (*U. S. Dispens.* ed. 16, 850), and from the green husk of the fruit nucin was obtained by A. Vogel and Reischauer (Gmelin's *Chemistry*, ed. Cav. xvii. 20), the juglandic acid of J. A. Buchner (*Buchner's Repertorium*, xxix. 355).

[6] Maximowicz, *Bull. Phys.-Mat. Acad. St. Pétersbourg*, xv. 177 (1856); *Prim. Fl. Amur.* 76; *Bull. Acad. Sci. St. Pétersbourg, l. c.* 58, f. (*Mél. Biol. l. c.* f.). — Alefeld, *l. c.* — C. de Candolle, *Prodr. l. c.* 138.

? Juglans stenocarpa, Maximowicz, *Prim. Fl. Amur.* 78; *Bull. Acad. Sci. St. Pétersbourg, l. c.* 59, f. (*Mél. Biol. l. c.* 632, f.).

Sieboldiana[1] of Japan. The type is an ancient one in Europe, from which later it entirely disappeared, existing in the cretaceous flora and abounding with many species during the tertiary epoch;[2] in North America traces of Juglans appear in the eocene rocks of the northern Rocky Mountain region and of the northwest coast from Vancouver's Island to Alaska, regions where no representative of the Walnut family now exists,[3] and in the auriferous gravel deposit of the California Sierra Nevada.[4]

Juglans produces handsome straight-grained light or dark brown wood valued in cabinet-making. The nuts of all the species are edible, and those of *Juglans regia* are important commercially. The juices of Juglans possess tinctorial properties, and are employed, especially those of the North American *Juglans cinerea*, to dye cloth yellow; and the bark, and husk of the fruit, which contain tannic acid, are sometimes used in tanning leather.

The different species of Juglans are preyed upon by numerous insects[5] and are subject to serious fungal diseases.[6]

Juglans regia octogona, Carrière, *Rev. Hort.* 1861, 429, f. 106, 107.

Pterocarya sorbifolia, Miquel, *Ann. Mus. Bot. Lugd. Bat.* iii. 103 (*Prol. Fl. Jap.*) (not Siebold & Zuccarini) (1867).

A native of northeastern Asia, where it was discovered by the Russian botanist Maximowicz, *Juglans Mandshurica*, which is hardly distinguishable from the North American *Juglans cinerea* in habit, foliage, and fruit, was introduced several years ago, through the agency of the Botanic Garden of St. Petersburg, into European and American gardens. In New England and northern Europe it is hardy and produces abundant crops of nuts (*Gard. Chron.* ser. 3, iv. 384, f. 53. — *Garden and Forest*, i. 396, 443).

[1] Maximowicz, *Bull. Acad. Sci. St. Pétersbourg*, xvii. 60, f. (*Mél. Biol.* viii. 633, f.) (1872). — Franchet & Savatier, *Enum. Pl. Jap.* 453. — Lavallée, *Icon. Hort. Segrez.* 1, t. 1, 2.

Juglans nigra, Thunberg, *Fl. Jap.* 195 (not Linnæus) (1784).

Juglans Mandshurica, Miquel, *l. c.* 104 (not Maximowicz) (1867). — Dupont, *Essences Forestières du Japon*, 62.

Juglans cordiformis, Maximowicz, *l. c.* 62, f. *l. c.* 635, f. (1872).

Juglans ailantifolia, Carrière, *l. c.* 1878, 414, f. 86.

Juglans macrophylla, Carrière, *l. c.* 415.

The Japanese Walnut is a common tree in the forests of Yeso, where it often attains the height of fifty feet, and is scattered through the mountain regions of the other islands. In its habit, in the color of its pale furrowed bark, in its racemose fruit, and in the pubescent covering of its young branches and the inner surface of its leaves, it resembles the North American *Juglans cinerea*. The nut, which varies greatly in size and shape, resembles in form and marking the nut of *Juglans regia;* it is moderately thin-shelled, with a large sweet edible kernel, and is an important article of food in all the northern districts of Japan, although the trees are not cultivated at least to any extent, the nuts sold in the markets being obtained from wild trees of the forest.

A peculiar flattened form of this nut, pointed at the apex and more or less cordate at the base (*Juglans cordiformis*), was found by the Russian naval officer Albrecht exposed for sale in the market of Hakodate; similar nuts, said to be brought from the forests of Fuji-san, are sold by the seedsmen of Yokohama, although the trees which produce them are not distinguished by the Japanese botanists (Sargent, *Notes on the Forest Flora of Japan*, 60). *Juglans Sieboldiana* was introduced many years ago by Siebold into European gardens; it is perfectly hardy in central Europe and in New England, where it produces fruit every year.

[2] C. de Candolle, *Ann. Sci. Nat.* sér 4, xviii. 38. — Saporta, *Origine Paléontologique des Arbres*, 294. — Zittel, *Handb. Palæntolog.* ii. 445, t. 272, f. 1–5.

[3] Lesquereux, *Rep. U. S. Geolog. Surv.* vii. 284, t. 54, f. 5–14, t. 55, 1–9, t. 56, 1–10, f. 58, f. 1, t. 62, f. 6–9; viii. 235, t. 46[a], f. 11 (*Contrib. Fossil Fl. W. Territories*, ii., iii.).

[4] Lesquereux, *Mem. Mus. Comp. Zoöl.* vi. pt. ii. 34 (*Fossil Plants of the Auriferous Gravel Deposits of the Sierra Nevada*).

[5] Although little is known of the insects which feed upon the species of Juglans that grow in the southwestern part of the United States, more than sixty kinds are recorded as preying upon this genus in North America. Of the wood-boring species, probably the worst known enemy of Juglans in America is the Hickory Borer, *Cyllene pictus*, Drury. Several other species, however, have been recorded as affecting the wood or bark, chiefly after they have begun to decay. Among scale insects *Aspidiotus Juglandis*, Fitch, and *Lecanium Juglandifex*, Fitch, are found on the bark of branches and twigs.

The species of foliage-eaters are numerous on Juglans. The larvæ of a handsome sphinx moth, *Smerinthus Juglandis*, Abbot & Smith, feed upon the leaves. These trees are favorite food-plants for the larvæ of the beautiful Luna Moth, *Actias Luna*, Linnæus, of *Citheronia regalis*, Fabricius, and other large Bombycids which seldom, however, cause much injury, and are often rather rare. *Datana ministra*, Drury, is sometimes very troublesome, especially in the western states, and *Datana integerrima*, Grote & Robinson, also occurs on our Walnut-trees. The webs of the Fall Web-worm, *Hyphantria cunea*, Drury, are often conspicuous on Walnut-trees in the eastern states, and the larvæ do considerable injury, sometimes entirely stripping the trees of foliage. The larvæ of numerous species of Catocala and other Noctuids are common on these trees.

Among smaller foliage-injuring Lepidoptera more or less peculiar to the genus is the Walnut case-bearer, *Acrobasis Juglandis*, Le Baron; and the larvæ of *Lithocolletis juglandiella*, Clemens, *Nepticula juglandifoliella*, Clemens, *Gracilaria juglandinigræella*, Chambers, and *Aspidisca juglandiella*, Chambers, live within the tissue of the leaves and make tortuous or blotch-mines beneath their epidermis.

A little beetle, *Paria aterrima*, Olivier, often eats numerous holes in the young leaves and devours the blossoms; a small flat Hemipteron, *Tingis Juglandis*, Fitch, is frequently found sucking the juices from the lower surface of the leaves of *Juglans cinerea;* and a weevil, *Conotrachelus Juglandis*, Le Conte, sometimes infests the fruit.

[6] Juglans in North America has few peculiar fungal enemies, and in general the same parasitic fungi which are found on it occur

The species of Juglans can be easily raised from seeds, which should not be allowed to dry before they are planted, as they soon become rancid and lose their power of germination.[1] The varieties can be propagated by grafting.

The generic name, the classical name of the Walnut-tree, from *Jupiter* and *glans*, was adopted by Linnæus, who discarded the older Nux of Tournefort.[2]

also on Hicoria and are not the cause of serious disease. *Microstroma Juglandis*, Saccardo, one of the most generally distributed fungi on the leaves of Walnuts and Hickories, appears as a thin whitish layer on the under surface of the leaves, causing them to curl and ultimately to shrivel up. In spite of its frequency, however, this fungus does comparatively little damage. A spot disease is produced on the leaves of *Juglans nigra* by *Cercospora Juglandis*, Kellerman & Swingle.

[1] Cobbett, *Woodlands*, 544. — Fuller, *Practical Forestry*, 158.

[2] *Inst.* 581, t. 346.

CONSPECTUS OF THE NORTH AMERICAN SPECIES.

Fruit racemose; nut prominently 4-ribbed at the sutures, 2-celled at the base; heartwood light brown.
- Leaflets 11 to 17, oblong-lanceolate . . . . . 1. J. CINEREA.

Fruit usually solitary or in pairs; nut without sutural ribs, 4-celled at the base; heartwood dark brown.
- Leaflets 15 to 23, ovate-lanceolate; nut deeply and irregularly ridged . . . . . 2. J. NIGRA.
- Leaflets 9 to 23, lanceolate to ovate-lanceolate; nut deeply sulcate . . . . . 3. J. RUPESTRIS.
- Leaflets 11 to 17, ovate-lanceolate; nut obscurely sulcate . . . . . 4. J. CALIFORNICA.

JUGLANS CINEREA.

Butternut. Oilnut.

LEAFLETS 11 to 17, oblong-lanceolate. Fruit oblong, acute, racemose; nut 4-ribbed at the sutures, deeply sculptured into thin ragged plates, 2-celled at the base.

Juglans cinerea, Linnæus, *Spec.* ed. 2, 1415 (1763). — Jacquin, *Icon. Rar.* i. 19, t. 192. — Moench, *Bäume Weiss.* 83. — Wangenheim, *Nordam. Holz.* 21, t. 9, f. 21. — Walter, *Fl. Car.* 235. — Willdenow, *Berl. Baumz.* 156; *Spec.* iv. 456; *Enum.* 979. — Castiglioni, *Viag. negli Stati Uniti*, ii. 263. —Borkhausen, *Handb. Forstbot.* i. 754. — Poiret, *Lam. Dict.* iv. 503; *Ill.* iii. 365, t. 781, f. 7. — Schmidt, *Oestr. Baumz.* iii. 38, t. 161. — Muehlenberg & Willdenow, *Neue Schrift. Gesell. nat. Fr. Berlin*, iii. 388. — Michaux, *Fl. Bor.-Am.* ii. 191. — Persoon, *Syn.* ii. 566. — Desfontaines, *Hist. Arb.* ii. 347. — Du Mont de Courset, *Bot. Cult.* ed. 2, vi. 235. — Stokes, *Bot. Mat. Med.* iv. 402. — Pursh, *Fl. Am. Sept.* ii. 636. — Bigelow, *Fl. Boston.* 230. — Nuttall, *Gen.* ii. 220. — Hayne, *Dendr. Fl.* 163. — Elliott, *Sk.* ii. 622. — Sprengel, *Syst.* iii. 865. — Audubon, *Birds*, t. 142. — Spach, *Hist. Vég.* ii. 170. — Rafinesque, *Alsograph. Am.* 66. — Hooker, *Fl. Bor.-Am.* ii. 143. — Torrey, *Fl. N. Y.* ii. 180. — Dietrich, *Syn.* v. 312. — Darlington, *Fl. Cestr.* ed. 3, 262. — Curtis, *Rep. Geolog. Surv. N. Car.* 1860, iii. 45. — Chapman, *Fl.* 419. — C. de Candolle, *Ann. Sci. Nat.* sér. 4, xviii. 16, t. 4, f. 45; *Prodr.* xvi. pt. ii. 137. — Koch, *Dendr.* i. 589. — Emerson, *Trees Mass.* ed. 2, 207, t. — Ridgway, *Proc. U. S. Nat. Mus.* 1882, 76. — Lauche, *Deutsche Dendr.* 305. — Sargent, *Forest Trees N. Am.* 10*th Census U. S.* ix. 130. — Watson & Coulter, *Gray's Man.* ed. 6, 467. — Dippel, *Handb. Laubholzk.* ii. 320. — Koehne, *Deutsche Dendr.* 76.

Juglans oblonga, Miller, *Dict.* ed. 8, No. 3 (1768). — Du Roi, *Harbk. Baumz.* i. 332. — Moench, *Meth.* 696.

Juglans oblonga alba, Marshall, *Arbust. Am.* 67 (1785).

Juglans nigra, β, Schoepf, *Mat. Med. Amer.* 139 (1787).

Juglans cathartica, Michaux f. *Hist. Arb. Am.* i. 165, t. 2 (1810).

Carya cathartica, Barton, *Compend. Fl. Phila.* ii. 178 (1818).

Wallia cinerea, Alefeld, *Bonplandia*, ix. 336 (1861).

A tree, occasionally one hundred feet high, with a tall straight trunk two to three feet in diameter and sometimes free of branches for half its height, but more frequently dividing, fifteen or twenty feet above the surface of the ground, into numerous stout limbs which spread horizontally often to a great length, and form a broad low symmetrical round-topped head. The bark of the trunk is from three quarters of an inch to an inch in thickness, and is light brown and deeply divided into broad ridges, which separate on the surface into small appressed plate-like scales; that of young trunks and of the branches is smooth and light gray. The branchlets, when they first appear, are coated, like the petioles, with rufous pubescence, which gradually disappears during the summer; and in their first winter they are dark orange-brown or bright green, rather lustrous, slightly puberulous, covered more or less thickly with pale lenticels, becoming brown tinged with red or orange in their second year, and then gradually losing their lustre and growing gray. The leaf-scars are light gray, and made conspicuous by the large black fibro-vascular bundle-scars and by the elevated bands of pale tomentum which separate them from the lowest axillary buds. The terminal buds are one half to two thirds of an inch in length and one quarter of an inch in breadth, and are somewhat flattened and obliquely truncate at the apex. The two outer scales are coated externally with short pale pubescence, and when fully grown are an inch long and one third of an inch wide; they are often narrowed into broad distinct stalks, and are thickened and rounded on the back and acute at the thickened apex; the inner scales are longer and broader, and are frequently obscurely pinnate, resembling the first leaves, which are an inch and a half long, with two or three pairs of small leaflets and thickened stalks widened from the base to the apex, where they are frequently half an inch across, and covered on the outer surface with rusty brown tomentum and on the inner with soft pale hairs. The axillary buds are ovate, flattened, rounded

at the apex, an eighth of an inch long, and covered with rusty brown or pale pubescence. The leaves are from fifteen to thirty inches long, with stout pubescent petioles and eleven to seventeen leaflets; these are oblong-lanceolate, acute or acuminate at the apex, finely serrate with minute callous teeth except at the unequally rounded base, and sessile or short-petiolulate, the terminal leaflet being raised on a slender stalk often two to three inches in length; when they unfold they are yellow-green, slightly glandular and sticky, lustrous and scurfy on the upper surface and puberulous on the lower; and at maturity they are three to four inches long, an inch and a half to two inches wide, thin, yellow-green, and rugose above, and pale and soft-pubescent below, with conspicuous pale midribs rounded on the upper side and conspicuous primary veins. In the autumn the leaves turn yellow or brown and fall early. The catkins of staminate flowers are covered during the winter with the closely imbricated conspicuous flower bracts coated with pale tomentum, and vary from a sixteenth to an eighth of an inch in length; they begin to lengthen during the month of May, and when fully grown are from three to five inches long, the flowers unfolding when the leaves have attained about half their size. The perianth of the flower, which is subtended by a bract covered with rusty pubescence and acute at the apex, is a quarter of an inch long, bright yellow-green, slightly puberulous on the outer surface, and usually six-lobed, the lateral lobes terminating in tufts of brown hairs; there are usually twelve or sometimes eight or ten stamens with nearly sessile dark brown anthers surmounted by their darker slightly lobed connectives. The female flowers are constricted above the middle and one third of an inch long, and are produced in six to eight-flowered spikes, maturing after the pollen of the staminate flowers has been mostly shed. The bract and bractlets which form the outer covering of the flower are coated with sticky white or pink glandular hairs; the bract is linear and acute, and is sometimes free at the base of the ovary or is often adnate to it to the middle; the bractlets are broadly ovate, acute, entire or irregularly cut at the apex into numerous small teeth, and rather shorter than the linear-lanceolate sepals, which are puberulous on the outer surface. The stigmas are clavate, spreading, bright red, and half an inch long. Three to five fruits often ripen on one branch; they are cylindrical, obscurely two or rarely four ridged, ovate-oblong, pointed, coated with rusty clammy matted hairs, and an inch and a half to two inches and a half in length. The nut is ovate or rarely obovate, abruptly contracted and acuminate at the apex, and furnished at the two sutures with thick broad ridges; alternate with these are two other ridges nearly or quite as prominent, and between these dorsal and marginal ridges are four others narrower and less developed; the thick hard wall is light brown, a quarter of an inch thick, and deeply sculptured on the outer surface between the ridges into thin broad irregular broken longitudinal plates, and contains numerous large internal longitudinal cavities; it is two-celled at the base and one-celled above the middle, with a narrow pointed apical cavity. The cotyledons are ovate-oblong, ridged on the back, slightly concave on the inner face, rounded and entire at the base, and abruptly contracted above into the long-pointed radicle.

Juglans cinerea prefers rich moist soil in which it grows near the banks of streams and on low rocky hills, and is distributed from southern New Brunswick, the valley of the St. Lawrence River and Ontario[1] to eastern Dakota[2] and southeastern Nebraska;[3] it ranges southward through the northern states to Delaware, southern Missouri,[4] and northeastern Arkansas,[5] and along the Apalachian Mountains to northern Georgia and the headwaters of the Black Warrior River in Winston County, Alabama.[6] One of the most abundant trees in the lowland forests of the north, south of the Ohio River the Butternut is nowhere very common and is usually of small size.

The wood of *Juglans cinerea* is light, soft, not strong, rather coarse-grained, and easily worked, with a satiny surface susceptible of receiving a beautiful polish; it is light brown, turning darker with

[1] Brunet, *Cat. Vég. Lig. Can.* 46. — Bell, *Geolog. Rep. Can.* 1878–80, 53°. — Macoun, *Cat. Can. Pl.* 434.

[2] McMillan, *Metaspermæ of the Minnesota Valley*, 177.

[3] Bessey, *Rep. Nebraska State Board Agric.* 1894, 109.

[4] Broadhead, *Bot. Gazette*, iii. 60.

[5] Harvey, *Am. Jour. Forestry*, i. 452.

[6] The Butternut has been seen by Dr. Charles Mohr in Alabama in Winston County only, where, however, it is exceedingly rare.

exposure, with thin light-colored sapwood composed of five or six layers of annual growth, and contains numerous regularly distributed large open ducts and thin obscure remote medullary rays. The specific gravity of the absolutely dry wood is 0.4086, a cubic foot weighing 25.46 pounds. It is now largely employed for the interior finish of houses and for furniture.

The inner bark is white, but becomes light yellow on exposure to the air and ultimately dark brown; it possesses mild cathartic properties, and is used, especially that of the root, with good results in the treatment of habitual constipation,[1] and in homœopathic practice.[2] Sugar of excellent quality has been made from the sap;[3] the kernel of the nut, which contains a large quantity of oil and soon becomes rancid, has a sweet and agreeable flavor while fresh; the oil was used by the Indians,[4] and the green husks of the fruit are employed domestically to dye cloth yellow or orange-color.

What is probably the earliest mention of the Butternut appears in *New England's Prospect*, by William Wood, published in London in 1639.[5] Introduced into European gardens at the close of the seventeenth century,[6] *Juglans cinerea* was first described in 1731 by Philip Miller.[7] The rapid growth in good soil, and the broad symmetrical head of the Butternut, make it a desirable ornamental tree where sufficient space can be allowed for the spread of its branches. Like many other trees, however, which unfold their leaves late in the spring, it loses them again after the first cold days of autumn.

[1] Schoepf, *Mat. Med. Amer.* 139. — B. S. Barton, *Coll.* i. 31; ii. 43. —Rush, *Med. Obs.* i. 112. —Bigelow, *Med. Bot.* ii. 115, t. 32. — Rafinesque, *Med. Bot.* ii. 234. — Lindley, *Fl. Med.* 307. — Griffith, *Med. Bot.* 589. — Carson, *Med. Bot.* ii. 42, t. 86. — Porcher, *Resources of Southern Fields and Forests*, 317. — Bentley & Trimen, *Med. Pl.* iv. 47, t. 247. — Johnson, *Man. Med. Bot. N. A.* 248. — *U. S. Dispens.* ed. 16, 850.

[2] Millspaugh, *Man. Am. Pl. in Homœopathic Remedies*, ii. 156, t. 156.

[3] M. P. Gray, *Mass. Agricultural Repository and Journal*, iii. 37.

[4] "Of these Wallnuts they make an excellent Oyle good for many uses, but especially for their annoynting of their heads. And of the chips of the Walnut-tree (the barke taken off) Some *English* in the Country make excellent Beere both for Taste, strength, colour, and in offensive opening operation." (Roger Williams, *A Key into the Language of America*, ed. Trumbull, 120.)

But as Walnuts and Hickories were confounded by all writers before the beginning of the present century, Roger Williams's observations refer probably to both these trees.

[5] "There is likewise a tree in some parts of the country, that beares a Nut as big as a small Peare" (pt. vi. 14).

[6] Aiton, *Hort. Kew.* iii. 361. — Loudon, *Arb. Brit.* 1439, f. 1262.

[7] *Nux Juglans Virginiana nigra, fructu oblongo, profundissimè insculpto, Dict.* No. 8. — Duhamel, *Traité des Arbres*, ii. 51.

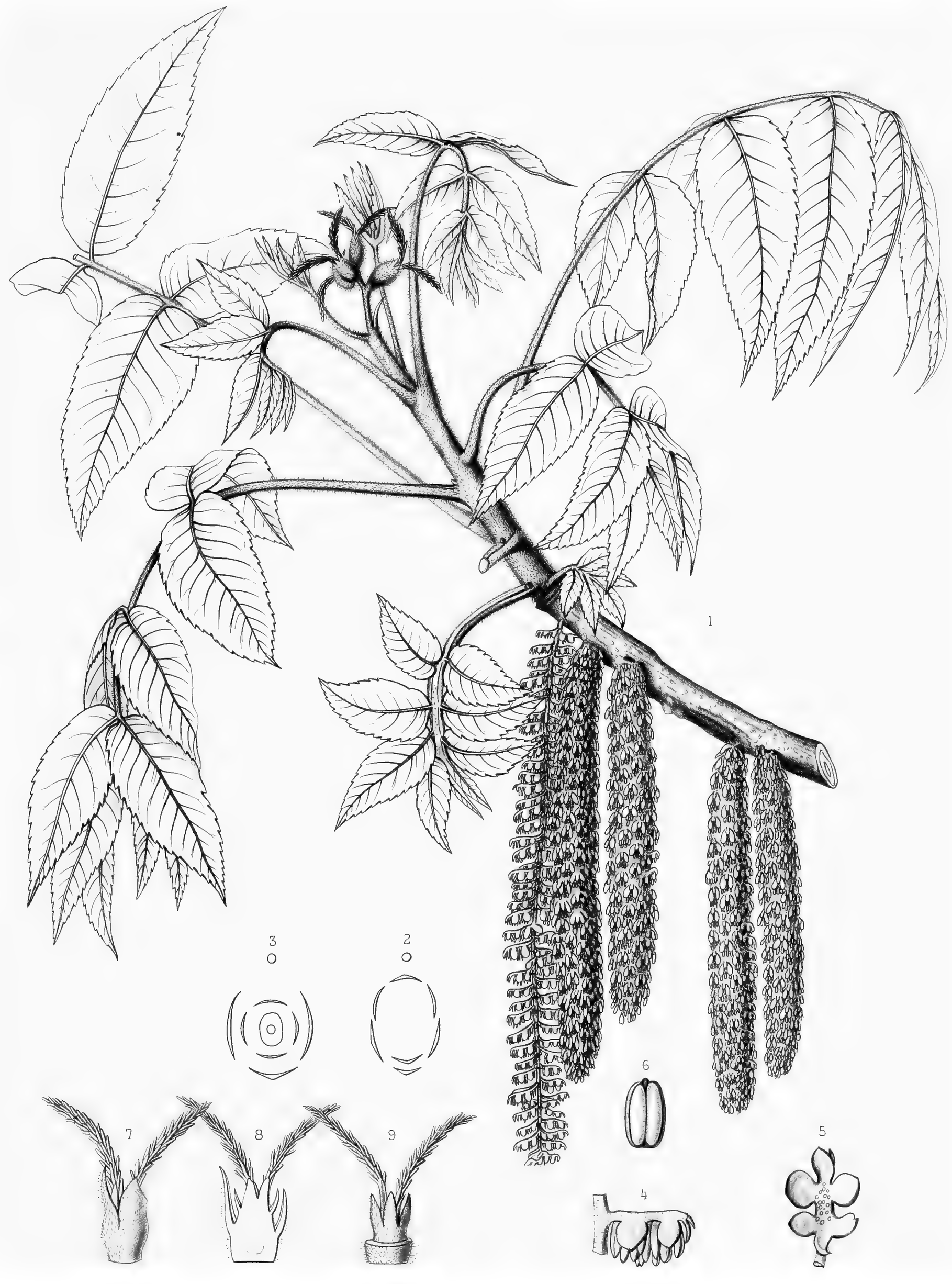
EXPLANATION OF THE PLATES.

PLATE CCCXXXI. JUGLANS CINEREA.

1. A flowering branch, natural size.
2. Diagram of a staminate flower.
3. Diagram of a pistillate flower.
4. A staminate flower, enlarged.
5. Perianth of a staminate flower displayed, enlarged.
6. A stamen, enlarged.
7. A pistillate flower, enlarged.
8. Vertical section of a pistillate flower, enlarged.
9. A pistillate flower, the bracts removed, enlarged.

PLATE CCCXXXII. JUGLANS CINEREA.

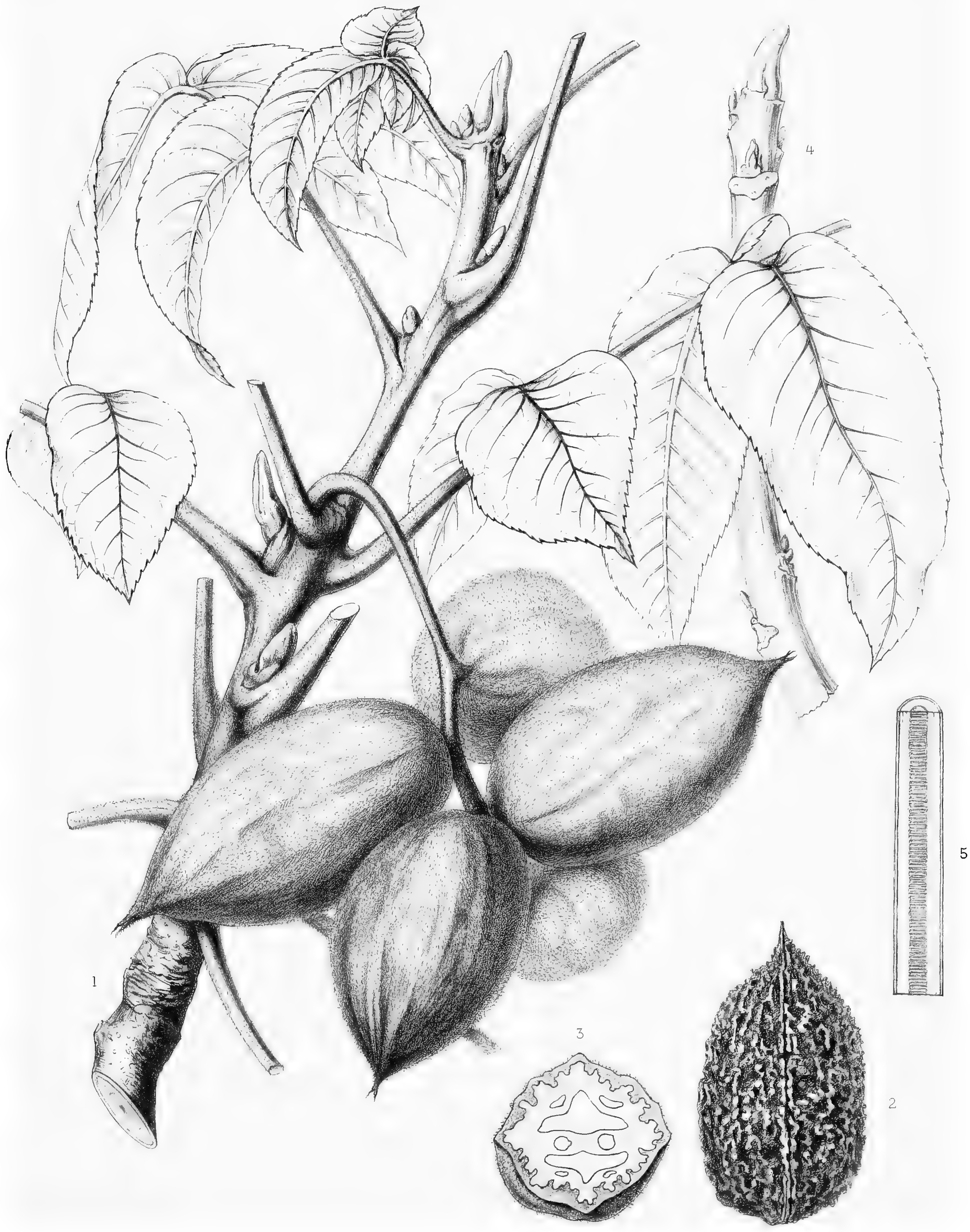
1. A fruiting branch, natural size.
2. A nut, natural size.
3. Cross section of a nut, natural size.
4. A winter branchlet, natural size.
5. Vertical section of a branchlet, showing the pith, natural size.



C.E. Faxon del Lövendal sc.

JUGLANS CINEREA, L.

A. Riocreux direx.t Imp. J. Taneur, Paris.



C.E.Faxon del.

Rapine sc.

JUGLANS CINEREA, L

A.Riocreux direx.t

Imp. J. Taneur, Paris.

JUGLANS NIGRA.

Black Walnut.

LEAFLETS 15 to 23, ovate-lanceolate. Fruit usually globose, solitary or in pairs; nut globose, deeply and longitudinally ridged, 4-celled at the base.

Juglans nigra, Linnæus, *Spec.* 997 (1753). — Miller, *Dict.* ed. 8, No. 2. — Du Roi, *Harbk. Baumz.* i. 329. — Wangenheim, *Beschreib. Nordam. Holz.* 60; *Nordam. Holz.* 20, t. 8, f. 20. — Jacquin, *Icon. Rar.* i. 19, t. 191. — Moench, *Bäume Weiss.* 83; *Meth.* 696. — Walter, *Fl. Car.* 235. — Willdenow, *Berl. Baumz.* 155; *Spec.* iv. 456; *Enum.* 978. — Poiret, *Lam. Dict.* iv. 502; *Ill.* iii. 365, t. 781, f. 6. — Abbot, *Insects of Georgia*, ii. t. 88. — Castiglioni, *Viag. negli Stati Uniti*, ii. 263. — Schmidt, *Oestr. Baumz.* iii. 37, t. 160. — Borkhausen, *Handb. Forstbot.* i. 751. — Muehlenberg & Willdenow, *Neue Schrift. Gesell. nat. Fr. Berlin*, iii. 388. — Michaux, *Fl. Bor.-Am.* ii. 191. — Persoon, *Syn.* ii. 566. — Desfontaines, *Hist. Arb.* ii. 347. — Du Mont de Courset, *Bot. Cult.* ed. 2, vi. 235. — Stokes, *Bot. Mat. Med.* iv. 403. — *Nouveau Duhamel*, iv. 179, t. 48. — Michaux f. *Hist. Arb. Am.* i. 157, t. 1. — Pursh, *Fl. Am. Sept.* ii. 636. — Nuttall, *Gen.* ii. 220; *Sylva*, 141. — Hayne, *Dendr. Fl.* 163. — Elliott, *Sk.* ii. 622. — Sprengel, *Syst.* iii. 865. — Watson, *Dendr. Brit.* ii. 158, t. 158. — Audubon, *Birds*, t. 84, 156. — Spach, *Hist. Vég.* ii. 168. — Rafinesque, *Alsograph. Am.* 66. — Torrey, *Fl. N. Y.* ii. 179. — Darlington, *Fl. Cestr.* ed. 3, 262. — Dietrich, *Syn.* v. 312. — Curtis, *Rep. Geolog. Surv. N. Car.* 1860, iii. 45. — Chapman, *Fl.* 419. — C. de Candolle, *Ann. Sci. Nat.* sér. 4, xviii. 35, t. 4, f. 44, 46; *Prodr.* xvi. pt. ii. 137. — Koch, *Dendr.* i. 587. — Emerson, *Trees Mass.* ed. 2, 211. — Schnizlein, *Icon.* t. 244, f. 1, 8, 12, 13. — Lauche, *Deutsche Dendr.* 305. — Sargent, *Forest Trees N. Am. 10th Census U. S.* ix. 131. — Watson & Coulter, *Gray's Man.* ed. 6, 467. — Dippel, *Handb. Laubholzk.* ii. 319. — Koehne, *Deutsche Dendr.* 74, f. 24 A. — Coulter, *Contrib. U. S. Nat. Herb.* ii. 412 (*Man. Pl. W. Texas*).

Juglans nigra oblonga, Marshall, *Arbust. Am.* 67 (1785).

Juglans Pitteursii, Morren, *Ann. Soc. Roy. Agric. et Bot. Gand*, iv. 179, t. 197 (1848).

Wallia nigra, Alefeld, *Bonplandia*, ix. 336 (1861).

Wallia fraxinifolia, Alefeld, *Bonplandia*, ix. 336 (excl. hab. Antilles) (1861).

Wallia nigra microcarpa, Alefeld, *Bonplandia*, ix. 336 (1861).

Wallia nigra macrocarpa, Alefeld, *Bonplandia*, ix. 336 (1861).

A tree, frequently one hundred feet, and occasionally one hundred and fifty feet high, with a straight trunk often clear of branches for fifty or sixty feet, and four to six feet in diameter, and stout limbs which spread gradually, and form a comparatively narrow shapely round-topped head of mostly upright rigid branches. The bark of the trunk is two or three inches thick, dark brown slightly tinged with red, and deeply divided into broad rounded ridges broken on the surface into thick appressed scales; that of young stems and of the branches is light brown, and separates in thin papery scales, which, as they fall, display the dark gray inner bark. The branchlets, when they first appear, are covered, like the petioles, with pale or ferrugineous matted pubescence, which gradually wears off during the summer or autumn, and in their first winter are dull orange-brown, pilose with short soft hairs, or puberulous, marked with raised conspicuous orange-colored lenticels, and with elevated pale leaf-scars; in their second and third years they gradually grow darker, and become light brown. The terminal buds are ovate, slightly flattened, obliquely rounded at the apex, coated with pale silky tomentum, one third of an inch long, and one quarter of an inch broad, and usually covered with four scales; those of the outer pair are rounded on the back, thickened, concave, and often obscurely pinnate or pinnately marked at the apex, and little, if at all, accrescent; those of the inner pair are pinnate at the apex, covered on the outer surface with rusty brown tomentum, and an inch long at maturity, and often resemble the scale-like short-lived upper leaves, which are composed of short broad flat petioles and of three or four pairs of leaflets. The axillary buds are obtuse, an eighth of an inch long, and coated with pale tomentum, their outer scales being open at the apex during the winter. The leaves are from one to two feet long, and are composed of pubescent petioles, and of from fifteen to

twenty-three leaflets, and not infrequently are equally pinnate by the suppression of the terminal leaflet; the leaflets are ovate-lanceolate, often unequal by the greater development of one side, long-pointed, sharply serrate with callous appressed teeth except at their more or less rounded unequal bases, and sessile or short-petiolulate; when they unfold they are lustrous, yellow-green, glabrous on the upper surface, and coated on the lower with rufous caducous tomentum; and at maturity they are thin, bright yellow-green, lustrous and glabrous above, and soft-pubescent below, especially along the slender midribs and primary veins; they are from three to three and a half inches in length, and from an inch to an inch and a quarter in breadth, and turn bright clear yellow in the autumn before falling. The catkins of staminate flowers protrude during the winter from the scales of the bud, and are coated with pale tomentum; at maturity they are three to five inches in length, and slightly puberulous. The bract is nearly triangular, coated with rusty brown or pale tomentum, and about one quarter of an inch long. The perianth is rotund and six-lobed, the lobes being nearly orbicular, concave, and pubescent on the outer surface. There are from twenty to thirty stamens arranged in many series, with nearly sessile purple anthers surmounted by the slightly lobed truncate connectives. The female flowers are produced in two to five-flowered spikes, and do not expand until the leaves have grown nearly to their full size; they are ovate, gradually narrowed to the apex, and one quarter of an inch long. The bract and bractlets are coated below with pale glandular hairs, and above are green and puberulous; they are sometimes irregularly cut into a laciniate border, or the bract is often undivided, and the bractlets are sometimes reduced to an obscure ring just below the apex of the ovary. The calyx-lobes are ovate, acute, light green, puberulous on the outer, glabrous or pilose on the inner surface, and a quarter of an inch long. The stigmas are club-shaped, yellow-green, tinged on the margins of the lobes with red, and one half to three quarters of an inch in length, and begin to wither before the anthers shed their pollen. The fruit, which is solitary or sometimes produced in pairs, is globose, oblong, or slightly pyriform, light yellow-green, roughened with clusters of short pale articulate hairs, and an inch and a half to two inches in diameter. The nut, which is oval or oblong and slightly flattened, without sutural ridges, often measures an inch and a half in its long diameter, and an inch and an eighth in its short diameter, and is dark brown tinged with red. The hard wall, which is frequently a quarter of an inch thick, is deeply divided on the outer surface into thin or thick often interrupted irregular ridges, and contains large irregular cavities. The interior of the nut is four-celled at the base by thick dissepiments, and slightly two-celled at the apex. The cotyledons are concave or sulcate on the back, deeply lobed at the base and apex, and abruptly narrowed into a short broad radicle.

Juglans nigra is distributed from western Massachusetts to southern Ontario,[1] and through southern Michigan and Minnesota to central and northern Nebraska[2] and eastern Kansas, and southward to western Florida, central Alabama and Mississippi, and the valley of the San Antonio River in Texas. An inhabitant of rich bottom-lands and fertile hillsides, and less common in the Atlantic states, the Black Walnut once abounded in the region west of the Alleghany Mountains, and was most abundant and grew to its largest size on the low western slopes of the high mountains of North Carolina and Tennessee and on the fertile river bottom-lands of southern Illinois and Indiana,[3] southwestern Arkansas and the Indian Territory.[4]

[1] Brunet, *Cat. Vég. Lig. Can.* 46. — Bell, *Geolog. Rep. Canada*, 1878–80, 53°. — Macoun, *Cat. Can. Pl.* 434.

[2] Bessey, *Rep. Nebraska State Board Agric.* 1894, 108.

[3] Eight Black Walnut trees grown in the bottoms of Greathouse Creek near Mount Carmel, Illinois, had an average height of one hundred and six feet one and one half inches, and an average trunk-diameter of three feet, while the tallest of them measured one hundred and nineteen feet six inches. A tree grown on the river-bottoms in the same locality had a trunk diameter of five feet six inches and a total height of one hundred and thirty-one feet; and a standing tree measured six feet in diameter three feet above the ground, and was estimated to be one hundred and fifty feet in height. (See Ridgway, *Proc. U. S. Nat. Mus.* 1882, 76.)

[4] Large Black Walnut trees practically no longer exist in the American forests. Many were cut down and burnt or split into fence-rails when the rich bottom-lands of the Mississippi Basin were cleared for agriculture. The sudden demand for gunstocks during the War of Secession greatly stimulated the demand, which has always been large for this wood for domestic use and for exportation; and during the last twenty years the agents of lum-

The wood of *Juglans nigra* is heavy, hard, strong, rather coarse-grained, easily worked, and very durable in contact with the soil; it contains numerous large irregularly distributed open ducts and many thin obscure medullary rays. It is rich dark brown, with a satiny surface susceptible of receiving a beautiful polish, and thin light-colored sapwood composed of ten to twenty layers of annual growth. The specific gravity of the absolutely dry wood is 0.6115, a cubic foot weighing 38.11 pounds. It is largely used in cabinet-making, in the interior finish of houses, for gunstocks and coffins, and in boat and ship building; its value was recognized by the early colonists, and when William Strachey visited Virginia in 1610 black walnut was already sent to the mother country,[1] and was an article of some commercial importance.

The nuts, which were valued by the Indians of the Mississippi Basin,[2] are still gathered for domestic use, and are sometimes offered for sale in the markets of western and southern cities, although the kernel, which is sweet and has a pleasant flavor while fresh, soon becomes rancid; the husks are used for dyeing.

Introduced into Europe about the middle of the seventeenth century[3] by the younger Tradescant,[4] *Juglans nigra* was first described by Parkinson in the *Theatrum Botanicum*.[5] A tree in the garden of the Bishop of London produced fruit before 1687.[6]

The Black Walnut is frequently used as an ornamental tree in the parks of the United States and of central Europe, and during the last twenty years many plantations of it have been made in the United States and Canada[7] in the hope of replacing by cultivation the wasted stores of walnut timber which once abounded in the forests of North America. As an ornamental tree the Black Walnut, with its massive trunk and handsome shapely head of beautiful foliage, is surpassed in beauty by few other inhabitants of the American forest, although the preference of the Fall Web-worm for its leaves and its early defoliation somewhat detract from its value as an ornamental tree for parks and pleasure-grounds.[8]

ber-dealers, penetrating into the most remote and inaccessible parts of the country, have bought up often singly and at merely nominal prices every Black Walnut tree of marketable size.

[1] "Of walnutts there be three kindes, the black walnutt which is returned home yearly by all shipping from thence, and yields good profitt, for yt is well bought up to make waynscott tables, cubbardes, chaires, and stooles, of a delicate grayne and cullour like ebonie, and not subject to the worme; the fruict of this is little, yt is thinne shelled, and the karnell bitter." (*The Historie of Travaile into Virginia Britannia*, ed. Major, 129.)

"The Walnut which is divers, some bearing square nuts, others like ours, but smaller: there is likewise black Walnut of precious use for Tables, Cabinets, and the like." (Josselyn, *An Account of Two Voyages to New England*, 69.)

[2] "Il en est de très-gros, dont le bois est presque aûssi noir que l'ébene; mais il a ses pores très ouverts. Leur fruit avec son bois est de la grosseur d'un œuf de poule; la coque en est très-raboteuse, sans césures, & si dur, qu'il faut un marteau pour la casser. La chair est enveloppée d'un bois si fort, que quoi-qu'elle soit d'un très-bon goût, la difficulté de les tirer en fait perdre l'envie: cependant les Naturels en font du pain. Comme ils venoient en ramasser sur ma Concession, où j'en avois un Bois de Haute-Futaye d'environ cent-cinquante arpens, je fus curieux de voir par quelle industrie ils parvenoient à détacher cette chair de son bois. Je les vis, après avoir cassé & pilé les noix, les mettre dans de grands vaisseaux, où ils jetterent beaucoup d'eau; ils frotterent ensuite cette espece de farine, & la manierent longtems entre leurs mains, de sorte que le bois & l'huile de la noix, qui est très-abondante dans ce fruit, vinrent au-dessus de l'eau, & la chair dégraissée tomba au fond par son propre poids. Il est à présumer qu'en greffant ces arbres avec du Noyer de France, on parviendroit à les rendre plus utiles." (Le Page du Pratz, *Histoire de la Louisiane*, ii. 25.)

[3] Aiton, *Hort. Kew.* iii. 360. — Loudon, *Arb. Brit.* iii. 1435, f. 1260, t.

[4] See i. 20.

[5] *Nux juglans nigra Virginiensis*, 1414. — Catesby, *Nat. Hist. Car.* i. 67, t. 67.

Nux juglans Virginiana nigra, Hermann, *Cat. Hort. Lugd.-Bat.* 452, t. — Boerhaave, *Ind. Alt. Hort. Lugd. Bat.* ii. 175.

Juglans foliolis lanceolatis tomentosis acute serrratis: superioribus minoribus, Linnæus, *Hort. Cliff.* 449. — Royen, *Fl. Leyd. Prodr.* 82.

[6] See Hermann, *l. c.*

[7] See Joly, *Rep. Montreal Horticultural and Fruit Growers' Association*, 1880, 23. — *Proc. Am. Forestry Congress*, 1885, 79.

Although the young cultivated trees grow rapidly, trees in the forest increase slowly in girth of trunk, and at least a century would be required in which to grow a Black Walnut tree, planted under the most favorable conditions in the best alluvial soil, to a size really valuable for timber. The log specimen in the Jesup Collection of North American Woods in the American Museum of Natural History, New York, grown in Missouri, has a trunk-diameter of twenty-six inches inside the bark, and shows one hundred and ninety-two layers of annual growth.

[8] As an ornamental tree the Black Walnut flourishes as far north as Montreal and Quebec; and on the Atlantic coast it is hardy as far north at least as eastern Massachusetts. A specimen standing on the estate of Mr. Peter C. Brooks of West Medford, Massachusetts, is believed to be from one hundred and fifty to one hundred and seventy-five years old. This noble tree is probably the largest in New England; in 1888 it had a trunk-circumference of thirteen feet six and one half inches at five feet above the sur-

face of the ground; and, although injured by lightning in 1878, is still in a healthy and vigorous condition. (See Dame & Brooks, *Typical Elms and other Trees of Massachusetts*, 68, t. 43.)

Specimens of *Juglans nigra* at least a century old may occasionally be seen in central and southern Europe. Few other North American deciduous-leaved trees have grown in Europe to so large a size; but the Black Walnut often suffers there from spring frosts in its early years, and produces wood so slowly that European foresters do not recommend it for general forest planting. (See Mayr, *Die Wald. Nordam.* 151, t. 4, f. — R. Hartig, *Ausl. Holz. bayer. Staatswald.* 35 [*Forst-nat. Zeit.* 1892].)

EXPLANATION OF THE PLATES.

PLATE CCCXXXIII. JUGLANS NIGRA.

1. A flowering branch, natural size.
2. A staminate flower before anthesis, enlarged.
3. A staminate flower, enlarged.
4. Perianth of a staminate flower displayed, enlarged.
5. A stamen, enlarged.
6. A pistillate flower, enlarged.
7. Vertical section of a pistillate flower, enlarged.
8. A leaf, reduced.
9. A winter branchlet, natural size.

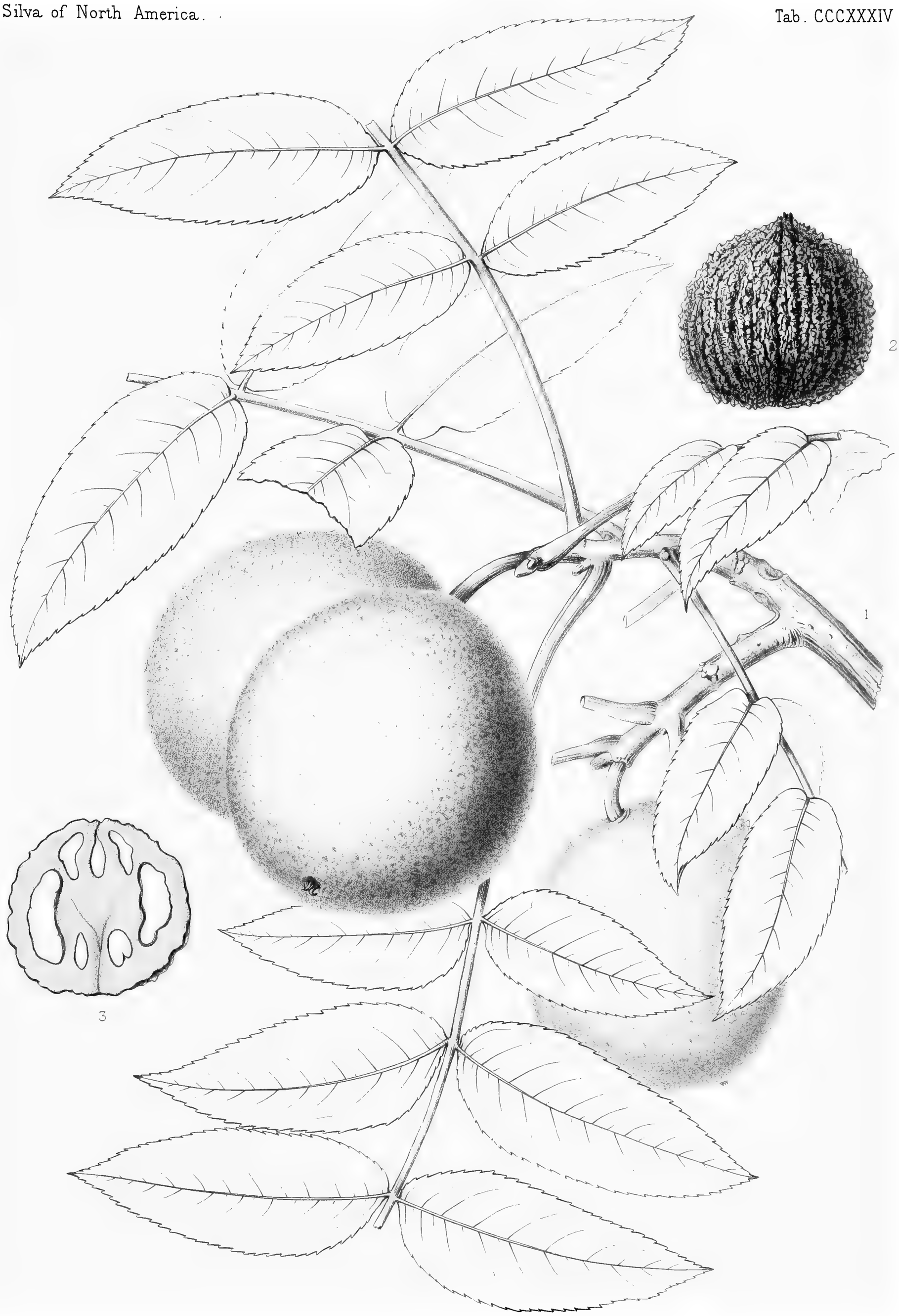
PLATE CCCXXXIV. JUGLANS NIGRA.

1. A fruiting branch, natural size.
2. A nut, natural size.
3. Cross section of a nut, natural size.

C.E.Faxon del. Toulet sc.

JUGLANS NIGRA, L.

A.Riocreux direx.t Imp. J. Taneur, Paris.



C.E. Faxon del.

Lebrun sc.

JUGLANS NIGRA, L.

A. Riocreux direx.t

Imp. J. Taneur, Paris.

JUGLANS RUPESTRIS.

Walnut.

LEAFLETS 9 to 23, lanceolate to ovate-lanceolate. Fruit usually spherical; nut globose, deeply sulcate, 4-celled at the base.

Juglans rupestris, Engelmann, *Sitgreaves' Rep.* 171, t. 15 (1853). — Torrey, *Bot. Mex. Bound. Surv.* 205; *Ives' Rep.* 27. — C. de Candolle, *Ann. Sci. Nat.* sér. 4, xviii. 28, t. 2, f. 11; *Prodr.* xvi. pt. ii. 138. — Brewer & Watson, *Bot. Cal.* ii. 93. — Rusby, *Bull. Torrey Bot. Club*, ix. 54. — Lauche, *Deutsche Dendr.* 305. — Hemsley, *Bot. Biol. Am. Cent.* iii. 164. — Sargent, *Forest Trees N. Am. 10th Census U. S.* ix. 131 (excl. syn. *Juglans Californica*). — Dippel, *Handb. Laubholzk.* ii. 323, f. 146. — Koehne, *Deutsche Dendr.* 75, f. 24 B. B. — Coulter, *Contrib. U. S. Nat. Herb.* ii. 412 (*Man. Pl. W. Texas*).

Juglans rupestris, var. **major**, Torrey, *Sitgreaves' Rep.* 171, t. 16 (1853); *Bot. Mex. Bound. Surv.* 205; *Pacific R. R. Rep.* vii. 20. — C. de Candolle, *Prodr.* xvi. pt. ii. 138.

Juglans Californica, Rothrock, *Wheeler's Rep.* vi. 249 (not Watson) (1878). — Coulter, *Contrib. U. S. Nat. Herb.* ii. 412 (*Man. Pl. W. Texas*).

A tree, sometimes fifty feet in height, with a short trunk occasionally four to five feet in diameter, and sometimes dividing near the ground, or usually ten or fifteen feet above it, into several stout branches, which are nearly upright throughout, forming a narrow head of rather formal outline, or, when the tree is growing in moist soil, sometimes begin to spread a few feet above the division of the trunk and become more or less pendulous at the extremities, making a handsome symmetrical round-topped head; or often reduced to a shrub sending up from the ground a cluster of stems only a few feet in height. The bark of the trunk varies from a quarter of an inch to nearly an inch in thickness, and is deeply furrowed and broken on the surface into thin appressed scales; that of young trunks and of the branches is smooth, pale, and sometimes nearly white. The branchlets, when they first appear, are coated, like the petioles, with a pale or light brown scurfy pubescence or tomentum, which often does not entirely disappear until the end of the second or third year; in their first winter they are orange-red, and marked by many small pale lenticels, growing lighter in their second season, and gradually become pale or nearly white. The terminal buds, which vary from one quarter to one half of an inch in length, are compressed, narrowed and often oblique at the apex, and are covered by two pairs of strap-shaped scales, the outer pair being pointed and often obscurely pinnate at the apex, and clothed with rusty or pale tomentum, while the inner pair are thicker, rounded on the back, flat on the inner face, and half an inch long when fully grown. The axillary buds are an eighth of an inch long, compressed, covered with dark scales, often open at the apex during the winter, and coated with pale pubescence. The leaves, composed of from nine to twenty-three leaflets and slender pubescent petioles, are from seven to fifteen inches in length; the leaflets are lanceolate, ovate-lanceolate or rarely ovate, acute, usually very unequal on the two edges, coarsely or finely crenulate-serrate nearly to the base, which is rounded on one and rounded or wedge-shaped on the other edge, and distinctly petiolulate or sometimes nearly sessile; when they unfold they are bronze-red, pubescent below, and puberulous above, and at maturity are from two and a half to five inches long, one third of an inch to an inch and a half wide, thin, dark yellow-green and glabrous, or often pubescent on the lower surface, especially along the stout yellow midribs and primary veins, which are also sometimes pilose above. In the autumn the leaves turn yellow before falling. The catkins of staminate flowers, which protrude slightly from the bud-scales during the winter, are slender, slightly puberulous, and from two and one half to four inches long. The bract of the staminate flower is ovate-lanceolate, acute, and coated with thick pale tomentum. The perianth, which opens in April and May after the leaves are about half-

grown, is three to five-lobed, nearly orbicular, light yellow-green, glabrous, or slightly pubescent on the lower surface, and raised on a slender stalk, which is about a quarter of an inch long. There are about twenty stamens, with nearly sessile yellow anthers and dark conspicuous slightly lobed connectives. The pistillate flowers, which are produced in few-flowered spikes, are narrowed at both ends, coated with pale or rufous tomentum, and from one eighth to one quarter of an inch in length; the bract and bractlets are green above, puberulous at the apex on the outer surface, and irregularly divided into a laciniately cut border rather shorter than the ovate-acute sepals, which are puberulous on the outer surface. The stigmas are club-shaped, spreading, green tinged with red, and one third of an inch long. The fruit is globose or rarely oblong, and varies from half an inch to an inch and a half in diameter, with a thin husk, glabrate or coated with short rufous articulate hairs. The nut is globose, without sutural ridges, often compressed at both ends and sometimes flattened laterally, dark reddish brown to black, and deeply sulcate with longitudinal simple or forked grooves; it is four-celled at the base and two-celled at the apex, with very thick hard walls, containing numerous interior cavities, and inclosing a small sweet kernel. The cotyledons are keeled on the back, flat or slightly concave on the inner face, more or less deeply lobed below and above, and abruptly contracted into the short pointed radicle.[1]

Juglans rupestris is distributed from the valleys of the upper Colorado, the Llano, and Guadaloupe Rivers in central Texas, westward through southern New Mexico and Arizona, and southward into the states of northern Mexico. In Texas, where it is common west of the ninety-eighth meridian on streams flowing to the Gulf of Mexico, *Juglans rupestris* is often shrubby, and is rarely more than thirty feet in height, growing on the limestone banks of streams or sometimes in their stony beds with the narrow-leaved Chestnut Oak, the Plane-tree, the Green Ash, the Cedar Elm, the Red Mulberry, and the black-fruited Persimmon; in New Mexico and Arizona, where it attains its largest size, it is a common inhabitant of cañons in all the mountain ranges south of the Colorado plateau, growing from their mouths up to elevations of six thousand feet, with Cottonwoods, the Black Willow, the Alder, and the Plane-tree, always close to the banks of the streams or in situations where the roots, penetrating deep into the soil, are able to secure a constant supply of water.

The wood of *Juglans rupestris* is heavy, hard, not very strong, and coarse-grained, with a satiny surface susceptible of receiving a good polish; it contains numerous irregularly distributed large open ducts and thin obscure medullary rays. It is rich dark brown, with thick nearly white sapwood. The specific gravity of the absolutely dry wood of the New Mexico and Arizona trees is 0.6861, a cubic foot weighing 42.74 pounds.

In New Mexico and Arizona the nuts are gathered and eaten by Mexicans and Indians. The kernel is very sweet and remains fresh for a long time, but its commercial value is lessened by its small size and the thickness and hardness of the walls which inclose it.

Juglans rupestris was discovered in western Texas in 1835[2] by the Belgian botanist Berlandier;[3] in 1868 it was growing in the Botanic Garden at Berlin;[4] and in 1879 it was introduced into the Arnold Arboretum by means of seeds gathered in western Texas. It is perfectly hardy in eastern Massachusetts, where as a low shrub it has ripened fruit.

In the cañons of the Arizona mountains *Juglans rupestris* is a handsome and conspicuous tree, particularly in winter, when its head of rigid white branches makes it peculiarly effective.

[1] The eastern and western forms of *Juglans rupestris* seem sometimes like distinct species; but in the extreme western part of Texas and in New Mexico the two forms grow together and appear to pass one into the other. The Texas form (Plate cccxxxv.) is distinguished by its smaller size, by its narrower, more glabrous, and more finely serrate leaflets, which are often nearly sessile, and by the small globose glabrate fruit and very thick-walled nut inclosing a kernel often scarcely larger than a pea. The western form (Plate cccxxxvi., the var. *major* of Torrey) is a larger tree, with broader and more coarsely serrate stalked leaflets, usually pubescent on the lower surface, larger fruit coated with rufous hairs, and a darker, more flattened, and more deeply sulcate nut with proportionately thinner walls and a larger kernel.

[2] No. 2459, "Rio de Medina, Texas, June, 1834."

[3] See i. 82.

[4] Teste, Herb. Engelmann.

EXPLANATION OF THE PLATES.

PLATE CCCXXXV. JUGLANS RUPESTRIS, FROM TEXAS.

1. A flowering branch, natural size.
2. A staminate flower, enlarged.
3. A stamen, enlarged.
4. Vertical section of a pistillate flower, enlarged.
5. A fruiting branch, natural size.
6. A nut, natural size.
7. Vertical section of a nut, natural size.
8. Cross section of a nut, natural size.
9. A winter branchlet, natural size.

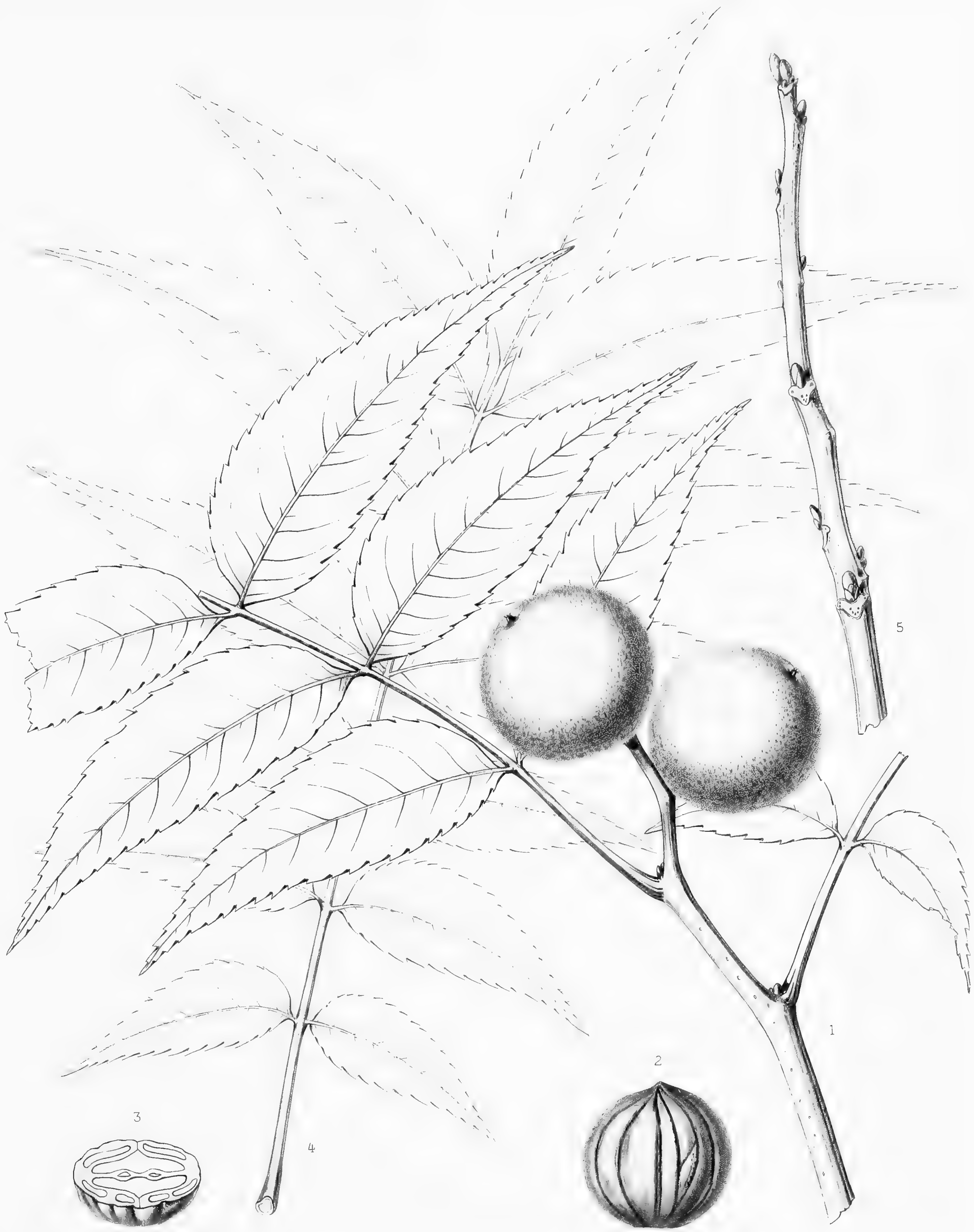
PLATE CCCXXXVI. JUGLANS RUPESTRIS, FROM ARIZONA.

1. A fruiting branch, natural size.
2. A nut, natural size.
3. Cross section of a nut, natural size.
4. A leaf, reduced.
5. A winter branchlet, natural size.

C.E. Faxon del. Rapine sc.

JUGLANS RUPESTRIS, Engelm.

A. Riocreux direx.t Imp. J. Taneur, Paris.



C.E. Faxon del.

Himely sc.

JUGLANS RUPESTRIS, Engelm.

A. Riocreux dirext

Imp. J. Taneur, Paris.

JUGLANS CALIFORNICA.

Walnut.

LEAFLETS 11 to 17, ovate-lanceolate. Fruit globose; nut obscurely and remotely sulcate, 4-celled at the base.

Juglans Californica, Watson, *Proc. Am. Acad.* x. 349 (excl. syn.) (1875). — Brewer & Watson, *Bot. Cal.* ii. 93 (excl. syn.). — Sargent, *Forest Trees N. Am.* 10*th Census U. S.* ix. 131 (in part). — Greene, *Man. Bot. Bay Region*, 301.

A tree, occasionally forty to sixty feet in height, with a trunk eighteen to twenty inches in diameter, and stout pendulous branches which form a symmetrical graceful round-topped head; or often much smaller, and sometimes shrubby in habit. The bark of the trunk is one third to one half of an inch in thickness, dark brown or nearly black, and deeply divided into broad irregular ridges, separating on the surface into thin appressed scales; that of young stems and the branches is smooth and pale or nearly white. The branchlets are covered when young with rufous scurfy tomentum, which soon disappears, and in their first winter are puberulous, dark reddish brown, and marked with pale scattered lenticels; becoming darker, and gradually glabrous in their second season, they begin to grow pale during their third year, and ultimately are nearly white. The terminal buds are acute, compressed, more or less oblique at the apex, coated with pale tomentum, and about a quarter of an inch long. The axillary buds, which are often solitary, are nearly globose, one sixteenth of an inch in length, and covered with thick pale or rufous tomentum. The leaves are composed of eleven to seventeen leaflets and of slender puberulous petioles, and are six to nine inches long; the leaflets are ovate-lanceolate, often somewhat falcate, long-pointed, coarsely crenulate-serrate except at the equally or unequally rounded or subcordate or wedge-shaped bases; when they unfold they are bronzy green and pilose, or covered with scurfy pubescence, and at maturity are thin, light green, glabrous, or sometimes furnished on the under surface with tufts of pale hairs in the axils of the primary veins, an inch and a half to three inches in length and one half to three quarters of an inch in width, with pale midribs and short stout petiolules grooved on the upper side. The staminate flowers, which open in April and May, when the leaves are nearly fully grown and after the stigmas of the female flowers have begun to wither, are produced in slender puberulous aments two to three inches long. The perianth is elongated, light green, coated like its bract on the outer surface with rufous pubescence, divided into five or six ovate acute lobes, and raised on a short slender stalk. There are from thirty to forty stamens with yellow anthers, surmounted by short connectives bifid at the apex. The pistillate flowers are broadly ovate or subglobose, glabrate or puberulous, and an eighth of an inch long. The free border of the bract and bractlets is ring-like and nearly entire, and much shorter than the broad ovate pubescent calyx-lobes. The stigmas are club-shaped, half an inch in length, and yellow. The fruit is globose, and three quarters of an inch to an inch and a quarter in diameter, with a thin dark-colored husk coated with short soft pubescence. The nut is nearly globose, without sutural ridges, slightly compressed, and sometimes flattened at both ends. It is dark brown, and obscurely sulcate with remote shallow grooves, and thin walls, and is four-celled at the base, with low basal medial partitions, a slightly divided apical cavity, and a large sweet kernel, which retains its sweetness and flavor for several months.

Juglans Californica is an inhabitant of the California coast region, where it grows along the banks of streams and on their bottom-lands, usually twenty or thirty miles from the sea, from the valley

of the lower Sacramento River to the southern slopes of the San Bernardino Mountains, where it sometimes ascends to an elevation of three thousand feet above the ocean level.[1]

The wood of *Juglans Californica* is heavy, hard, and rather coarse-grained, with a satiny surface susceptible of receiving a good polish. It contains numerous regularly distributed open ducts and thin obscure medullary rays, and is dark brown, and often handsomely veined and mottled, with thick pale sapwood, composed of eight or ten layers of annual growth. The specific gravity of the absolutely dry wood is 0.6266, a cubic foot weighing 39.04 pounds.

Juglans Californica appears to have been first noticed by Dr. C. C. Parry,[2] who found it in 1850 north of Los Angeles.[3]

Juglans Californica is often cultivated in California as a shade-tree, and is sometimes used there as a stock upon which to graft different varieties of *Juglans regia*. Introduced into Europe through the Arnold Arboretum, it flowered in the spring of 1889 in the garden of the Villa Thuret at Antibes in southern France.

[1] S. B. Parish, *Zoë*, iv. 345.

[2] Charles Christopher Parry (1823–1890) was born at Admington, in Gloucestershire, England, and in 1833 came to America with his family, who settled on a farm in Washington County, New York. He was graduated from Union College at Schenectady, and subsequently from the Medical School of Columbia College, New York. In 1846 Dr. Parry established himself in his profession at Davenport, Iowa, which he considered his home during the remainder of his life, although he soon abandoned the practice of medicine to devote himself to botanical exploration in northern Wisconsin, Iowa, and Minnesota, along the southern boundary of the United States as botanist of the United States and Mexican Boundary Commission, in southern California, in Colorado, whose alpine flora he first made known, in southern Utah, in Wyoming and Montana, in Lower California, Mexico, and San Domingo. No other botanist of his generation explored so many unexplored fields in North America or revealed so many undescribed North American plants, *Pinus aristata*, *Pinus Torreyana*, *Pinus Parryana*, *Picea pungens*, and *Picea Engelmanni* being among the trees which he added to our silva.

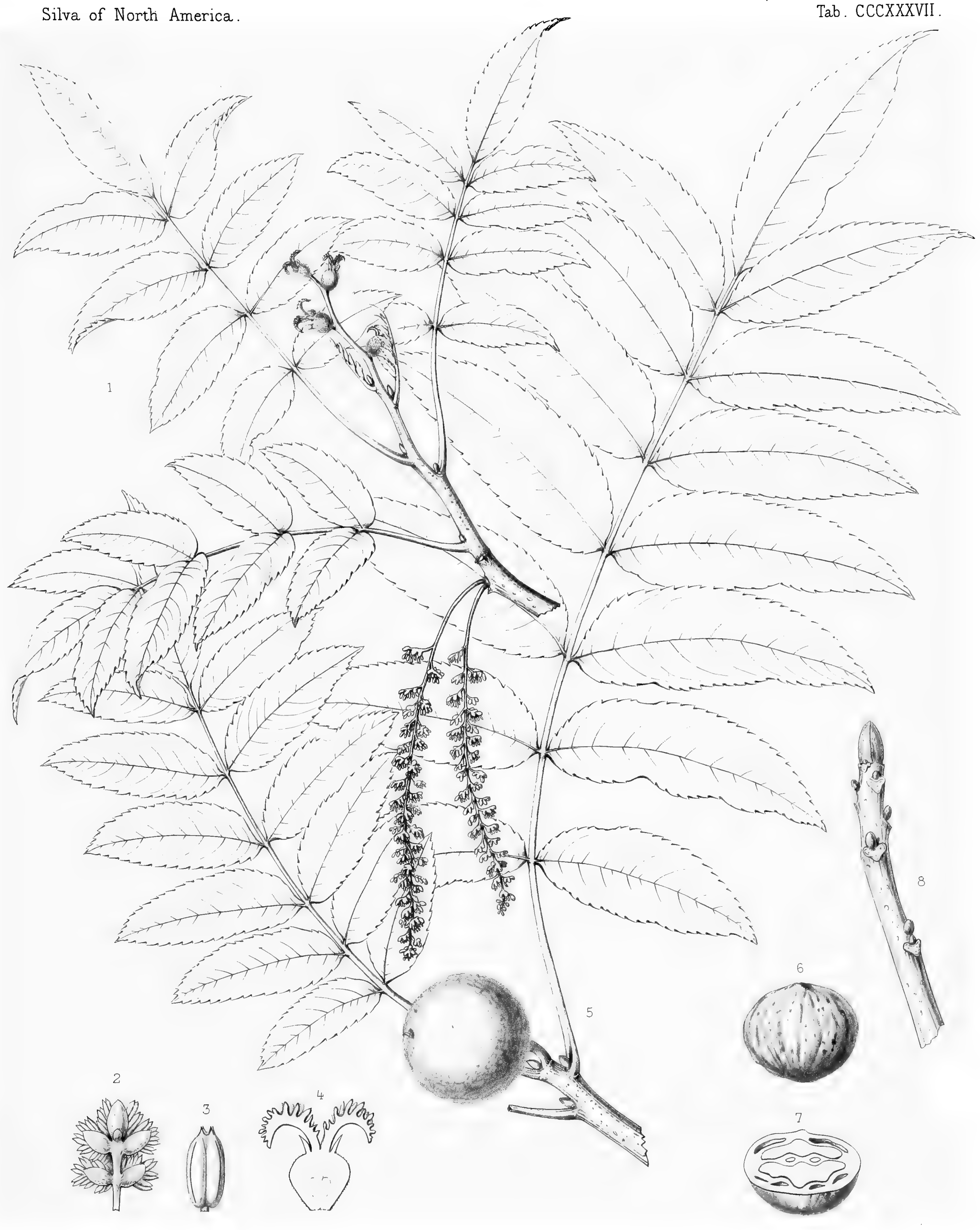
Dr. Parry was the author of many papers published in scientific journals and in the *Proceedings of the Davenport Academy of Science*, of which he was one of the founders and for many years the president. One of the peaks of the Snowy Range of Colorado bears the name of this indefatigable and successful explorer, and *Parryella* of Gray, a shrub discovered by him on the banks of the Rio Grande in New Mexico, reminds American botanists how greatly they are indebted to his zeal, industry, and intelligence. His herbarium, gathered in the wanderings of forty-eight years, and containing duplicate types of his discoveries, has been acquired by the Agricultural College of Iowa. (See Preston, *Proc. Davenport Acad. Sci.* vi. 35, for a sketch of Dr. Parry's life and a list of his writings.)

[3] Torrey, *Bot. Mex. Bound. Surv.* 205.

EXPLANATION OF THE PLATE.

PLATE CCCXXXVII. JUGLANS CALIFORNICA.

1. A flowering branch, natural size.
2. A pistillate flower, rear view, enlarged.
3. A stamen, enlarged.
4. Vertical section of a pistillate flower, enlarged.
5. A fruiting branch, natural size.
6. A nut, natural size.
7. Cross section of a nut, natural size.
8. A winter branchlet, natural size.



C.E.Faxon del.

Himely sc.

JUGLANS CALIFORNICA, Wats.

A.Riocreux direx.t

Imp. J. Taneur, Paris.

HICORIA.

Flowers monœcious, apetalous; calyx of the staminate flower unequally 2 to 3-lobed, the lobes imbricated in æstivation; stamens 3 to 10; calyx of the pistillate flower 1-lobed; ovary inferior, 1-celled, surrounded by a 4-lobed involucre; ovule solitary, erect. Fruit a nut inclosed in the 4-valved thickened involucre. Leaves alternate, unequally pinnate, destitute of stipules, deciduous.

Hicoria (**Scoria**), Rafinesque, *N. Y. Med. Rep.* hex. ii. v. 352 (1808); *Alsograph. Am.* 65. — Baillon, *Hist. Pl.* xi. 405 (Scoria).

Carya, Nuttall, *Gen.* ii. 220 (1818). — Meisner, *Gen.* 74. — Endlicher, *Gen.* 1126. — C. de Candolle, *Ann. Sci. Nat.* sér. 4, xviii. 36. — Bentham & Hooker, *Gen.* iii. 398. — Engler, *Engler & Prantl Pflanzenfam.* iii. pt. i. 25.

Aromatic resinous trees, with watery juice, scaly bark, tough strong hard brown wood, tough terete flexible branchlets, solid pith, scaly buds, long stout perpendicular roots and thick fibrous rootlets covered with thick dark-colored bark. Buds covered with few valvate, or with numerous imbricated accrescent and often bright-colored scales; the axillary buds superposed two or three together and often stalked, or solitary. Leaves alternate, unequally pinnate, many or few-foliolate, often glandular dotted, deciduous, the lowest often scale-like and short-lived, with broad flat stalks and few small leaflets, the uppermost frequently reduced to small bract-like acute bodies, more or less persistent during the winter. Petioles elongated, terete, flattened and grooved on the upper side, and gradually enlarged toward the base, often persistent on the branches during the winter, leaving in falling large elevated oblong or semicircular more or less three-lobed emarginate leaf-scars displaying small marginal clusters and central radiating lines of dark fibro-vascular bundle-scars. Leaflets involute in vernation, ovate or obovate, usually acuminate, thick and firm, serrate, mostly unequal at the entire base, usually increasing in size from the lower to the upper, sessile or short-petiolulate, or the terminal leaflet raised on a long stalk, penniveined, the veins forked and running to the margin of the leaflet and connected by reticulate cross veinlets, turning clear bright yellow in the autumn, and often separating from the petiole in falling. Staminate flowers appearing in late spring after the unfolding of the leaves from buds in the axils of the last leaves of the year, or at the base of branches of the year from the inner scales of the terminal bud, in solitary or fascicled pedunculate ternate aments, the lateral aments produced from the axils of lanceolate acute persistent bracts. Calyx usually two, rarely three-lobed, subtended by an ovate acute elongated bract free nearly to the base, and usually much longer than the ovate rounded calyx-lobes. Stamens three to ten, inserted in two or three series on the slightly thickened torus-like inner and lower face of the calyx; filaments abbreviated, free; anthers ovate-oblong, emarginate or divided at the apex, pilose or hirsute, two-celled, the cells opening longitudinally, as long or longer than their slender connective. Ovary wanting. Pistillate flowers mostly proterogynous, sessile, in two to ten-flowered clusters or spikes borne on a peduncle terminal on a leafy branch of the year. Calyx reduced to a single posterior lobe. Ovary inferior, one-celled, formed of two transverse carpels, crowned with two sessile persistent median commissural spreading stigmas papillo-stigmatic on the inner face, inclosed in a perianth-like slightly four-ridged involucre, composed by the more or less complete union of an anterior bract and two lateral bractlets, adnate below to the ovary, unequally four-lobed at the apex, cup-shaped, villous on the outer surface, the bract exterior in

æstivation and much longer than the bractlets and calyx-lobe;[1] ovule solitary, erect from the bottom of the cell, orthotropous. Fruiting involucre ovoid, globose, or pyriform, thin or thick, becoming hard and woody at maturity, four-valved, the sutures alternate with those of the nut, sometimes more or less broadly winged, splitting promptly or tardily to the base or to the middle, marked on the inner surface with broad dark veins radiating from the thickened base. Nut oblong, obovate, or subglobose, acute, acuminate or rounded at the apex, and tipped by the hardened remnants of the styles, narrowed and usually rounded at the base furnished with the usually persistent hardened acute point of attachment to the involucre, cylindrical or compressed contrary to the valves, separating by the dorsal sutures in germination into two valves, the valves alternate with the cotyledons, their walls thin and brittle, or thick, hard and bony, smooth or variously rugose or ridged on the outer surface and containing numerous large or narrow longitudinal lacunæ or interior cavities filled with dark or light astringent coarse powder, four-celled at the base by the development to above the middle of a thin dorsal partition at right angles with the valves, and by a lower ventral partition in their direction, and two-celled at the apex by the projection downward into the cavity of a thick partition at right angles with the dorsal basal partition, and divided to receive the short broad point of the seed. Seed solitary, filling the cavity of the nut, exalbuminous, two-lobed from the bottom nearly to the middle, the lobes oblong, compressed, variously grooved on the back by the projection inward of longitudinal ridges on the walls of the nut, concave on the inner face, more or less deeply two-lobed at the apex, the connective thick and short-pointed; testa thin, membranaceous, of two coats, the outer coat light brown. Embryo flat, oily, sweet or bitter; radicle short, superior, filling the apex of the cavity of the nut.[2]

Hicoria is confined to the temperate regions of eastern North America, and is distributed from the valley of the St. Lawrence River to the highlands of Mexico, where one[3] endemic species occurs. Nine species are known, eight of which inhabit the territory of the United States, the headquarters of the genus as represented by the greatest number of species being in southern Arkansas. Traces of Hicoria have been found in the tertiary rocks of Greenland;[4] palæontologists have described numerous species from the upper tertiary formation of Europe,[5] and there are evidences that it once ranged in North America far to the westward of its present home.[6]

Many of the species of Hicoria produce strong tough and very valuable wood[7] and edible nuts of

[1] The involucral character of the outer covering of the pistillate flower of Hicoria is shown by the fact that it sometimes contains two or three ovaries, producing two or three separate or more or less united nuts inclosed in one husk. (See Gray, *Proc. Phil. Acad.* 1884, 15.)

[2] The species of Hicoria may be grouped in the following sections:—

Apocarya (C. de Candolle, *Prodr.* xvi. pt. ii. 144). Buds compressed, covered with four scales valvate in æstivation, the inner slightly accrescent, often obscurely pinnate at the apex; axillary buds superposed two or three together, often stipitate, the outer scales united into a sack soon opening at the apex. Catkins of staminate flowers usually from separate or rarely leaf-bearing buds in the axils of leaves of the previous year, and formed before midsummer, or occasionally at the base of shoots of the year. Husk of the fruit thin, prominently ridged at the sutures; nut cylindrical or compressed, not at all or obscurely ridged; the walls and partitions thin and brittle, or in one species thick and hard; lacunæ large, irregular, filled with dark powder, or in one species small; kernel sweet or bitter.

Eucarya (C. de Candolle, *l. c.* 142). Buds covered with ten to twelve closely imbricated scales, the outer opening in the autumn, and falling before winter or early in the spring, the inner accrescent, large, and often brightly colored and reflexed at maturity; axillary buds solitary, their outer scales at first sometimes united into a sack. Catkins of staminate flowers at the base of young branches from the axils of the inner bud-scales. Husk of the fruit thick or rarely thin, without sutural ridges, or in one species obscurely ridged; nut compressed, more or less prominently four-ridged and angled; the walls and partitions thick and bony; lacunæ minute, filled with light yellow powder; kernel sweet.

[3] *Hicoria Mexicana*, Britton, *Bull. Torrey Bot. Club*, xv. 283 (1888).

Carya Mexicana, Engelmann, *Hemsley, Bot. Biol. Am. Cent.* iii. 162 (1882).

[4] Saporta, *Origine Paléontologique des Arbres*, 296.

[5] Zittel, *Handb. Palæontolog.* ii. 447, f. 272, 4–8.

[6] Newberry, *Ann. Lyc. N. Y.* ix. 72 (*Notes on the Later Extinct Floras of North America*). — Lesquereux, *U. S. Geolog. Surv.* vii. 289, t. 57, f. 1–5, t. 58, f. 2; viii. 236 (*Contrib. Fossil Fl. W. Territories*, ii., iii.).

[7] No other wood equals the best Hickory in strength and toughness combined with lightness. The Indians knew its value, and used it for the handles of their tools. (See Le Page du Pratz, *Histoire de la Louisiane*, ii. 26.) The European colonists soon learnt its quality, and, writing early in the seventeenth century, William Wood in the *New England's Prospect* (14) tells us: "The Walnut tree is something different from the *English* Walnut, being a great deale more tough, and more serviceable, and altogether as heavie:

commercial importance. Oil made from the kernels of the nuts was used by the Indians,[1] who also pressed a milky substance from them;[2] the bitter astringent inner bark has been employed successfully in the treatment of dyspepsia and intermittent fever,[3] and in homœopathic practice;[4] and a yellow dye is obtained from the inner bark. No other trees give greater dignity and character to the forests of eastern North America or surpass the Hickories in vigor and beauty of appearance.[5] Numerous insects[6]

and whereas our Gunnes that are stocked with *English* Walnut, are soone broken and cracked in frost, being a brittle wood; wee are driven to stocke them new with the Country Walnut, which will indure all blowes, and weather; lasting time out of minde. These trees beare a very good Nut, something smaller, but nothing inferiour in sweetnesse and goodnesse to the *English* Nut, having no bitter pill."

Their Hickory-wood handles have made American axes known all over the world, and it is to the light American carriages, only made possible by the use of Hickory wood in their construction, that the American trotting horse, one of the greatest triumphs of the breeder's art, owes his superiority. Hickory wood is the best fuel yielded by the American forests; and for hoops no other American wood equals it.

[1] "The third sort is, as this last, exceeding hard shelled, and hath a passing sweet karnell; this last kind the Indians beat into pieces with stones, and putting them, shells and all, into morters, mingling water with them, with long woodden pestells pound them so long togither untill they make a kind of mylke, or oylie liquor, which they call powcohicora." (Strachey, *The Historie of Travaile into Virginia Britannia*, ed. Major, 129.)

"The Wild Wallnut, or Hiquery-Tree, gives the *Indians*, by boyling its Kernel, a wholesome Oyl, from whom the *English* frequently supply themselves for their Kitchen uses: It's commended for a good Remedy in Dolors, and Gripes of the Belly; whilst new it has a pleasant Taste; but after six Moneths, it decays and grows acid; I believe it might make a good Oyl, and of as general an use as that of the Olive, if it were better purified and rectified." (Thomas Ash, *Carolina, or a Description of the Present State of that Country*, 12.)

"Hiccory Nuts have very hard Shells, but excellent sweet Kernels, with which, in a plentiful Year, the old Hogs, that can crack them, fatten themselves, and make excellent Pork. These Nuts are gotten, in great Quantities, by the Savages, and laid up for Stores, of which they make several Dishes and Banquets. One of these I cannot forbear mentioning; it is this: They take these Nuts, and break them very small betwixt two Stones, till the Shells and Kernels are indifferent small; And this Powder you are presented withal in their Cabins, in little wooden Dishes; the Kernel dissolves in your Mouth, and the Shell is spit out. This tastes as well as any Almond. Another Dish is the Soup which they make of these Nuts, beaten, and put into Venison-Broth, which dissolves the Nut, and thickens, whilst the Shell precipitates, and remains at the bottom. This Broth tastes very rich." (Lawson, *History of Carolina*, 98.)

[2] "The fruit is in great estimation with the present generation of Indians, particularly *Juglans exaltata*, commonly called shell-barked hiccory. The Creeks store up the last in their towns. I have seen above an hundred bushels of these nuts belonging to one family. They pound them to pieces, and then cast them into boiling water, which, after passing through fine strainers, preserves the most oily part of the liquid: this they call by a name which signifies hiccory milk; it is as sweet and rich as fresh cream, and is an ingredient in most of their cookery, especially homony and corn cakes." (William Bartram, *Travels in North America*, 38.)

[3] *U. S. Dispens.* ed. 16, 1744.

[4] Millspaugh, *Am. Med. Pl. in Homœopathic Remedies*, ii. 157.

[5] Porcher, *Resources of Southern Fields and Forests*, 322.

[6] In the Fifth Annual Report of the United States Entomological Commission, published in 1890, one hundred and sixty-nine species of insects are recorded as living upon Hicoria, and very little is known of those which attack these trees in the southern states. Many insects that injure the Hickories feed also on other plants, although a large number seem to confine themselves to this genus. More than fifty species are known to affect the bark and wood of the trunk and branches, both when they are green and after they have become dry. A large portion of these wood-borers are the larvæ of beetles belonging to the family Cerambycidæ. *Cyllene pictus*, Drury, which resembles the common Locust-borer, often does serious injury to the Hickories. *Goes tigrinus*, De Geer, and several other species of this genus, are often common on these trees, in the larval state boring first into the bark and sapwood and later into the solid wood. *Chion cinctus*, Drury, is often destructive to drying hickory timber. (See *Garden and Forest*, i. 148.) *Saperda discoidea*, Fabricius, and *Stenosphenus notatus*, Olivier, are also said to affect the Hickories, and several species of Dicerca and Chrysobothris, are common on them. Larvæ of such minute beetles as *Sinoxylon basilare*, Say, and *Apate basilaris*, Say, often make deep slender tunnels in the dry wood. A twig-girdler, *Oncideres cingulatus*, Say, and *Elaphidion villosum*, Fabricius, sometimes cut off the small branches. Some species of Agrilus, *Acanthoderes quadrigibbus*, Say, *Liopus cinereus*, Leconte, and the larvæ of several other beetles bore into the branches and twigs, although frequently not until the wood is dead. The Hymenopterous, *Tremex Columba*, Linnæus, is reputed to be a destructive borer of the Hickory in some localities. *Chramesus Icoriæ*, Le Conte, and *Scolytus 4-spinosus*, Say, and several other species of Scolytidæ; and Magdalis, and other Curculionidæ, live in the bark of dead or living trees. A scale insect, *Lecanium Caryæ*, Fitch, and large masses of aphids, like *Eriosoma Caryæ*, Fitch, *Lachnus Caryæ*, Harris, are found on the surface of the bark of young branches.

The Hickories are favorite food-plants of several species of the large Silk-spinners and other Bombycidæ which also feed upon the foliage of Juglans, and of numerous species of Catocala. *Halesidota Caryæ*, Harris, is often common, and the Fall Web-worm and the larvæ of *Datana ministra*, Drury, frequently defoliate the branches. The larvæ of *Phycis rubrifasciella*, Packard, live in the buds and leaf-stalks in spring and early summer, and some other Pyralidæ and some species of Tortricidæ and Tineidæ live either in the folded leaves or in curiously constructed cases which protect their bodies. *Gelechia caryævorella*, Packard, lives within the young leaves, which it rolls up, and larvæ of *Coleophora caryæfoliella*, Chambers, live in cylindrical cases on the under surface of the leaves. Among leaf-miners which attack the Hickories are *Lithocolletis caryæfoliella*, Clemens, *Lithocolletis caryæalbella*, Chambers, and *Nepticula caryæfoliella*, Clemens. The leaves of Hickories are frequently affected by numerous species of gall-making insects, which often twist and disfigure them. Between fifteen and twenty distinct kinds of galls have been described as formed by different species of Phylloxera on these trees, *Phylloxera caryæcaulis*, Fitch,

prey upon and do considerable injury to all the species of the genus, which, however, are comparatively free from fungal diseases.[1]

Hickories can be raised from seeds,[2] which should not be allowed to become dry, as they soon lose their power of germination, and the varieties can be propagated by grafts.

The generic name[3] is formed from the popular name of these trees.[4]

being one of the most conspicuous, as on the leaf-stalks and young shoots it makes large hollow leathery galls which do not disappear during the winter. Various species of galls formed by Cecidomyidæ are common on these trees and peculiar to them.

Among plant-lice *Monella caryella*, Fitch, and some species of Callipterus, are common on the foliage. Numerous species of Hemiptera belonging to the Jassidæ or Leaf-hoppers, and to the Membracidæ or Tree-hoppers are found on them, but apparently do them little injury.

The young fruits and the mature fruit-husks of Hicoria are often much mined and eaten by the larvæ of *Grapholitha caryana*, Fitch, a small Tortrix moth, and by some other allied species. The nuts are frequently infested by a weevil, *Balaninus nasicus*, Say, while *Balaninus rectus*, Say, is also reported as attacking the fruit.

[1] The disease which probably attracts more attention than any other that affects Hicoria appears in the form of very rough tumors on the side of the smaller branches or nearly surrounding them, some trees being covered with hundreds of such knot-like excrescences, presenting a curious appearance after the leaves have fallen, and often remaining on the branches for years. It was long supposed that these knots were the result of the visitation of some insect. This is now denied by entomologists ; yet as microscopical examination does not show the constant presence of any fungus, and as the Hickory tumors resemble those formed on the Olive in Europe, which some vegetable palæontologists believe are due to bacteria, although others do not agree with them, it is possible that the tumors of Carya may have a similar origin despite the fact that no exact observations have yet confirmed this view.

Microstroma Juglandis, Saccardo, is one of the most widely distributed fungi on the leaves of Hicoria, appearing as a thin white layer on the under surface of the leaflets and causing them to curl and ultimately to shrivel up. Two spot-diseases on the leaves of Hickory-trees are due to *Phyllosticta Caryæ*, Peck, and *Ramularia albo-maculata*, Peck ; neither of them does the trees any serious damage.

[2] Cobbett, *Woodlands*, 298. — Fuller, *Practical Forestry*, 115.

[3] The generic name proposed by Rafinesque, who first separated the Hickories from the Walnuts in 1808, was originally printed Scoria, but this was evidently a misprint, as in 1817 Rafinesque himself corrected it to Hicoria in the *Flora Ludoviciana*, 109 ; and again in 1816 in the *Alsographia Americana*, where he reëstablished his genus, dividing it into four subgenera, based principally on the character of the kernel of the nut.

The distinctions between Walnut-trees and Hickories were disregarded by all the botanists of the eighteenth century, although Caspar Bauhin had recognized the fact as early as 1623 that there were Walnuts of two very different sorts in Virginia (*Pinax*, 417).

[4] Hickory is from the Virginian powcohicora or pawcohiccora, the name of the milk, or oily liquor obtained by pounding the kernels. Hickory nuts were called pâcan by the Indians of the seaboard, a general name for all nuts hard enough to require a stone or hammer to crack them ; and this name was appropriated by the French settlers of the Mississippi basin for the nuts of one of the species (*Hicoria Pecan*). The thin-shelled nut of the eastern Shag-bark Hickory was distinguished by northern Algonkins as one to be cracked with the teeth (Abn. s' kwskadámenne) ; this by the descendants of the Dutch settlers in New York was changed into Cuskatominy or Cruskatominy, or, as written by Michaux (*Hist. Arb. Am.* i. 190), Kiskythomas nut. (See Trumbull, *Trans. Am. Philological Soc.* 1872, 25.)

CONSPECTUS OF THE NORTH AMERICAN SPECIES.

APOCARYA. Bud-scales valvate; catkins of staminate flowers usually from buds formed in the axils of leaves of the previous year; fruit ridged at the sutures; nut subcylindrical, or in one species much compressed and angled, the wall thin and brittle, or in one species thick and bony; lacunæ usually large; kernel sweet or bitter.

Catkins of staminate flowers fascicled, nearly sessile, usually on branches of the previous year.

Leaflets 13 to 15, oblong-lanceolate, more or less falcate; nut ovate-oblong; cylindrical, thin-shelled; kernel sweet . . . . . 1. H. PECAN.

Catkins of staminate flowers pedunculate from branches of the year or of the previous year.

Leaflets 7 to 11, lanceolate or oblong-lanceolate; nut often broader than long, thin-shelled, slightly 4-angled; kernel bitter . . . . . 2. H. MINIMA.

Leaflets 7 to 11, ovate-lanceolate to lanceolate-obovate; nut ellipsoidal, cylindrical, thick-shelled; kernel sweet . . . . . 3. H. MYRISTICÆFORMIS.

Leaflets 7 to 13, lanceolate, more or less falcate; nut compressed, rugose, thin-shelled; kernel bitter . . . . . 4. H. AQUATICA.

EUCARYA. Bud-scales imbricated; catkins of staminate flowers pedunculate on branches of the year. Fruit without sutural ridges, or in one species slightly ridged; walls of the nut thick and bony; lacunæ minute; kernel sweet.

Bark separable from old trunks in long loose plates.

Leaflets 5 to 7, ovate to oblong-lanceolate or obovate; nut thick or thin-walled, ovate, more or less flattened and 4-angled, pale or nearly white . . . . . 5. H. OVATA.

Leaflets 5 to 9, obovate or oblong-lanceolate, puberulous on the lower surface; nut ovate, thick-walled, prominently 4-angled, dull white to light reddish brown . . . 6. H. LACINIOSA.

Bark closely furrowed, rarely exfoliating in plate-like scales.

Leaflets 7 to 9, oblong-lanceolate or obovate-lanceolate, more or less tomentose on the lower surface, very fragrant; nut globose or oblong, often long-pointed, 4-ridged toward the apex, thick-shelled, reddish-brown . . . . . 7. H. ALBA.

Leaflets usually 5 to 7, oblong or obovate-lanceolate, glabrous or villous-pubescent; fruit pyriform or globose; husk usually thin, slightly ridged at the sutures; nut oblong, oval, or globose, thick or thin-shelled . . . . . 8. H. GLABRA.

HICORIA PECAN.

Pecan.

LEAFLETS 9 to 11, lanceolate or oblong-lanceolate, more or less falcate. Fruit four-winged nearly to the base; nut ovate-oblong, cylindrical, thin-shelled; kernel sweet.

Hicoria Pecan, Britton, *Bull. Torrey Bot. Club*, xv. 282 (1888). — Dippel, *Handb. Laubholzk.* ii. 340, f. 156. — Koehne, *Deutsche Dendr.* 73, f. 23 H. H′. H″. — Coulter, *Contrib. U. S. Nat. Herb.* ii. 410 (*Man. Pl. W. Texas*).

Juglans Pecan, Marshall, *Arbust. Am.* 69 (1785). — Walter, *Fl. Car.* 236. — Borkhausen, *Handb. Forstbot.* i. 759. — Muehlenberg & Willdenow, *Neue Schrift. Gesell. nat. Fr. Berlin*, iii. 392. — Du Mont de Courset, *Bot. Cult.* ed. 2, vi. 236.

Juglans Illinoinensis, Wangenheim, *Nordam. Holz.* 54, t. 18, f. 43 (excl. fruit) (1787).

Juglans angustifolia, Aiton, *Hort. Kew.* iii. 361 (1789). — Stokes, *Bot. Mat. Med.* iv. 400.

Juglans alba, ϵ pacana, Castiglioni, *Viag. negli Stati Uniti*, ii. 262 (1790).

Juglans cylindrica, Poiret, *Lam. Dict.* iv. 505 (1797); *Ill.* iii. 365, t. 781, f. 5. — *Nouveau Duhamel*, iv. 178.

Juglans olivæformis, Michaux, *Fl. Bor.-Am.* ii. 192 (1803). — Willdenow, *Spec.* iv. 457; *Enum.* 979; *Berl. Baumz.* ed. 2, 194. — Persoon, *Syn.* ii. 566. — Desfontaines, *Hist. Arb.* ii. 348. — Michaux f. *Hist. Arb. Am.* i. 173, t. 3. — Aiton, *Hort. Kew.* ed. 2, v. 296. — Pursh, *Fl. Am. Sept.* ii. 636. — Hayne, *Dendr. Fl.* 163.

Carya olivæformis, Nuttall, *Gen.* ii. 221 (1818). — Sprengel, *Syst.* iii. 849. — Spach, *Hist. Vég.* ii. 173. — Scheele, *Roemer Texas*, 447. — Ed. Morren, *Belge Hort.* 223, vi. t. 45, f. 2. — Torrey, *Bot. Mex. Bound. Surv.* 205. — Chapman, *Fl.* 418. — C. de Candolle, *Ann. Sci. Nat.* sér. 4, xviii. 36, t. 1, f. 3, t. 6, f. 59; *Prodr.* xvi. pt. ii. 144. — Ridgway, *Proc. U. S. Nat. Mus.* 1882, 77. — Hemsley, *Bot. Biol. Am. Cent.* iii. 163. — Sargent, *Forest Trees N. Am. 10th Census U. S.* ix. 132. — Havard, *Proc. U. S. Nat. Mus.* viii. 506. — Watson & Coulter, *Gray's Man.* ed. 6, 468. — Mayr, *Wald. Nordam.* 161, t. 4.

Carya angustifolia, Sweet, *Hort. Brit.* 97 (1827). — Nuttall, *Sylva*, i. 41.

Carya tetraptera, Liebmann, *Vidensk. Medd. fra nat. For. Kjöbenh.* 1850, 80.

Hicoria Texana, Le Conte, *Proc. Phil. Acad.* 1853, 402.

? Carya Texana, C. de Candolle, *Ann. Sci. Nat.* sér. 4, xviii. 33 (1862); *Prodr.* xvi. pt. ii. 145.

Carya Illinoënsis, Koch, *Dendr.* i. 593 (1869). — Lauche, *Deutsche Dendr.* 307, f. 124.

Hicorius Pecan, Sargent, *Garden and Forest*, ii. 460 (1889).

A tree, one hundred to one hundred and seventy feet in height, with a tall massive trunk occasionally six feet in diameter above its enlarged and buttressed base, and stout slightly spreading branches which form in the forest a narrow symmetrical and inversely pyramidal, or, where they find room to spread, a broad round-topped head. The bark of the trunk is an inch to an inch and a half in thickness, light brown tinged with red, and deeply and irregularly divided into narrow forked ridges broken on the surface into thick appressed scales. The bark of the young stems and branches is smooth and light reddish brown. The branchlets, when they first appear, are slightly tinged with red and coated with loose pale tomentum which soon wears away, and in their first winter they are glabrous or puberulous, or pubescent toward the extremities, and are marked with numerous oblong orange-colored lenticels and with large oblong obscurely three-lobed concave leaf-scars surrounded by a broad thin membranaceous border which embraces the lower axillary bud. The terminal buds are acute, compressed, half an inch long, covered with clusters of bright yellow articulate hairs, and during the winter are coated with pale tomentum; the scales are strap-shaped, often obscurely pinnate at the apex, bright green on the inner surface and slightly accrescent. The axillary buds are ovate, acute, compressed, and covered with clusters of yellow articulate hairs, and are often stalked, especially the upper one of the node, which is frequently twice as large as the buds below. The leaves are from twelve to twenty inches in length, and are composed of from nine to seventeen leaflets and of slender glabrous

or pubescent petioles flattened and slightly grooved along the upper side toward the base; the leaflets are lanceolate or oblong-lanceolate and more or less falcate, and increase in size from the lowest to the uppermost; they are long-pointed, and coarsely and often doubly serrate with incurved cartilaginous teeth, rounded or sometimes wedge-shaped on one side and shorter and wedge-shaped on the other at the base, and are borne on stout petiolules often a quarter of an inch long, or are sometimes sessile with the exception of the terminal leaflet, which is symmetrical and wedge-shaped at the base and raised on a slender stalk an inch or an inch and a half in length; when they unfold the leaflets are bright green and glandular, and, like the petioles, are coated with thick pale tomentum which soon disappears; at maturity they are thin and firm, dark yellow-green and glabrous or pilose on the upper, and pale and glabrous or pubescent on the lower surface, from four to eight inches in length and from an inch to three inches in width, with narrow yellow midribs rounded on the upper side, and thin conspicuous veins. The staminate flowers appear in late spring in slender puberulous clustered aments three to five inches long, usually produced from buds formed in the axils of leaves of the previous year, or occasionally on shoots of the year, and sessile or short-pedunculate; the perianth is light yellow-green and hirsute on the outer surface, with broadly ovate acute lobes rather shorter than the oblong or obovate bract, which is narrowed at both ends and twice as long as the nearly sessile yellow stamens. The pistillate flowers are oblong, narrowed at both ends, slightly four-angled and coated with yellow scurfy pubescence, with an ovate more or less elongated bract, broadly ovate bractlets, and an ovate acute calyx-lobe. The fruit, which is produced in clusters of from three to eleven, is oblong, pointed, four-winged and angled, one to two and a half inches long, half an inch to an inch broad, dark brown and more or less thickly coated with clusters of yellow articulate hairs; the husk is about a sixteenth of an inch thick, hard and brittle, and splits at maturity nearly to the base, discharging the nut and often remaining on the branch during the winter. The nut is ovoid to ellipsoidal, nearly cylindrical or slightly four-angled toward the acute or acuminate apex, rounded and usually apiculate at the base, bright reddish brown with irregular black marks, and one to two inches in length, with thin brittle walls, thin papery partitions, the basal ventral partition being often not more than an eighth of an inch high, and large irregular lacunæ filled with a dark astringent powder. The seed is sweet, ovate-oblong, divided from the base to above the middle, and covered with a red-brown coat; the lobes are rounded and slightly divided at the base, nearly flat and slightly grooved on the inner face, and rounded on the outer, which is marked from near the base to the apex by two deep longitudinal grooves caused by ridges on the wall of the nut, and rounded and two-lobed at the apex, with lobes as long as the short flattened point of their connective.

Hicoria Pecan is distributed from the valley of the Mississippi River, where it probably finds its most northern home in the neighborhood of Sabula, Iowa, through southern Illinois and Indiana, western Kentucky and Tennessee, to central Mississippi and Alabama,[1] and through Missouri and Arkansas to southeastern Kansas, the Indian Territory, western Louisiana, and the valley of the Concho River in Texas, reappearing on the mountain ranges of Mexico. The largest of the Hickory-trees, the Pecan inhabits low rich ground in the neighborhood of streams, growing to its greatest size on the fertile bottom-lands of southern Arkansas and the Indian Territory, and in western Texas surpassing all other trees in size and value.[2]

[1] Mohr, *Garden and Forest*, vi. 372.

[2] A Hickory-tree that sprung up twenty-five or thirty years ago near a planted Pecan-tree in Hamilton County, Ohio, with pubescent winter branchlets, small bright yellow buds, leaves composed of four or five pairs of narrow falcate leaflets, oblong thin-husked fruit prominently ridged from base to apex, an oblong-obovate compressed and slightly angled nut with a somewhat bitter kernel, is perhaps a hybrid between *Hicoria Pecan* and *Hicoria minima*. (See S. J. Galloway, *Gardening*, ii. 226, f.)

A remarkable Hickory-tree, evidently a hybrid between *Hicoria Pecan* and one of the true Hickories, probably *Hicoria laciniosa* or *Hicoria alba*, growing in Wabash County, Illinois, was made known by Dr. Jacob Schneck of Mount Carmel in the autumn of 1894. This tree has stout pubescent branchlets, the large terminal buds of the true Hickories, solitary axillary buds covered with valvate or, in one specimen, with imbricated scales, broad leaflets, and oblong fruit nearly two and a half inches in length; the husk, which is dark brown on the outer surface, is a third of an inch thick and,

The wood of *Hicoria Pecan* is heavy, hard, not very strong, brittle and close-grained, with numerous thin medullary rays and bands of one or two rows of large open ducts marking the layers of annual growth. It is light brown tinged with red, with thin lighter brown sapwood. The specific gravity of the absolutely dry wood is 0.7180, a cubic foot weighing 44.75 pounds. Less valuable than the wood of most of the other species of Hickory, it makes excellent fuel, and is now occasionally used in the manufacture of wagons and agricultural implements.

The nuts, which vary in size and shape, in the thickness of their shells and in quality, are an important article of commerce. They are usually gathered for market from wild trees, Texas producing the largest quantity; but in recent years orchards of Pecan-trees raised from selected nuts have been planted in many of the southern states.[1]

Growing remote from the Atlantic seaboard, *Hicoria Pecan* was not known to the early Europeans who explored the American forests; in 1704 Pénicaut, a follower of Bienville, noticed the nuts among the fruits used in the village of the Natchez Indians on the Mississippi,[2] and they were described by Charlevoix[3] and Le Page du Pratz[4] in the narratives of their travels in Louisiana; and, according to Aiton, the tree was introduced into European gardens in 1766.

splitting nearly to the base, remains on the branch after discharging the nut; this is oblong, two inches long, two thirds of an inch broad, short-pointed, slightly compressed, slightly or conspicuously angled, and light reddish brown, with thin walls and partitions, large irregular lacunæ, and a sweet kernel.

[1] Deep sandy loam, into which its long roots, sometimes descending to a depth of twenty feet, may penetrate freely, is best suited for the cultivation of the Pecan-tree, while boggy land with water standing near the surface is least favorable to its vigorous growth. The trees are usually set from forty to eighty feet apart in straight rows, according to the quality of the soil, the best soil supporting the greatest number of trees. Seedling trees one or two years old are generally used; and some of the most experienced Pecan planters recommend cutting back the tap-root to the length of fifteen or twenty inches to make it branch and thus increase the number of roots. In order to keep the ground clear of weeds, a crop of cotton, corn, or potatoes is often grown among the trees during their first year; and a crop of clover or cow-peas may be plowed under the second year with advantage to the young trees. When the trees are three or four years old the ground can be laid down to permanent pasture and grazed with sheep or calves, and the orchard will require no further care beyond the fertilization of the trees to increase their productiveness. The seedling trees are raised from selected nuts planted as soon as ripe, in rows four feet apart, and are covered with three or four inches of soil; during the first year they grow from eight to fifteen inches in height. Seedlings vary in the size and quality of the nuts they produce, and even when raised from the finest nuts produce small and inferior fruit. The best results are obtained by using plants grafted with scions taken from selected trees, although the first cost of such plants is high. The Pecan can be grafted by a ring-graft of the bark, by tongue and by cleft-grafting; but the operation is delicate and difficult, and often fails unless performed by an experienced hand.

A pound of Pecan nuts usually contains from eighty to one hundred and twenty nuts, although forty to sixty of the largest nuts sometimes weigh a pound. Several named varieties, selected on account of their size, the thinness of their shells, and the quality of their kernels, are now cultivated. Columbian is slightly broader above than below the middle, short-pointed at the apex, full and rounded at the base, sometimes two inches and a quarter long and one inch and an eighth broad. Jewett is a slender acuminate nut nearly two and one half inches long and seven eighths of an inch broad, with a prominent basal point. Van Deman is a broad obovate nut short-pointed at the full apex, gradually narrowed at the rounded base, about two inches long and two thirds of an inch broad. Stuart is rather fuller below than above the middle, nearly equally short-pointed at both ends, very symmetrical, one and one third inches long and three quarters of an inch broad. Beauty is slightly obovate, somewhat angled at the full short-pointed apex, gradually and regularly narrowed at the base, an inch and three quarters long and three quarters of an inch broad. (See *The Pecan and How to Grow It*, 58, t. 4; see, also, Mohr, *Garden and Forest*, ii. 569. — Van Deman, *Rep. U. S. Dept. Agric.* 1890, 415, t. 1, 2.)

In the forest the Pecan-tree, like other Hickories, does not grow rapidly. The log specimen in the Jesup Collection of North American Woods in the American Museum of Natural History, New York, grown in Missouri, is twenty-four inches in diameter inside the bark, and shows one hundred and twenty-nine layers of annual growth, of which twenty are of sapwood. In cultivation, however, and when abundantly fertilized, it grows rapidly and begins to produce fruit in small quantities at the end of eight or ten years. Two Pecan-trees, planted in 1872, when two years old, by Dr. Charles Mohr in his garden in Mobile, in sandy land originally covered with Pine-trees, are now from sixty-five to seventy feet high, with trunks five feet eleven inches and five feet eight inches in circumference three feet above the ground; and four trees in the same garden, planted in 1880, are all about fifty feet high with trunks which, at three feet above the ground, girth four feet nine inches, four feet five inches, four feet eight inches, five feet nine inches, and five feet five inches.

[2] "Ils ont de trois sortes de noyers; il y en a dont les noix sont grosses comme le poing, et qui servent à faire du pain pour leur soupe, mais les meilleures ne sont guères plus grosses que le poulce; ils les appellent pacanes." (Margray, *Mémoires et Documents*, v. 445 [*Description du Village de Natchez*].)

[3] "Le Pacane est une Noix de la longueur & de la figure d'un gros Gland. Il y en a dont la coque est fort mince, d'autres l'ont plus dure & plus épaisse, & c'est autant de défalqué sur le fruit: elles sont même un peu plus petites. Toutes sont d'un goût fin and delicat; l'Arbre, qui les porte, vient fort haut: son bois, son écorce, l'odeur & la figure de ses feuilles m'ont paru assez semblables aux Noyers d'Europe." (*Journal d'un Voyage fait par ordre du Roi dans l'Amérique Septentrionale*, vi. 141.)

[4] "Il y a encore les Pacaniers dont le fruit est une espèce de

The Pecan, with its tall straight trunk and great head of cheerful yellow-green foliage, is one of the impressive trees of eastern North America; and as ornamental trees some of the wide-branched specimens, planted early in the century to shade the homes of the Creole planters of Louisiana and now grown to vast proportions, rival the Elms of the New England farmhouse and the Live Oaks of the Carolina mansion in stateliness and grandeur.

noix fort petite, & qu'on prendroit au coup d'œil pour des noisettes, parce qu'elles en ont la forme, la couleur, & la coque aussi tendre ; mais en dedans elles sont figurées comme les noix : elles sont plus délicates que les nôtres, moins huilleuses & d'un goût si fin, que les François en font des prâlines aussi bonnes que celles d'amandes." (*Histoire de la Louisiane*, ii. 26.)

The first description of the Pecan-tree was published in the *Arbustum Americanum* of Marshall, who evidently had never seen it; the next account was that of Wangenheim, drawn up from a small cultivated tree in the nursery of William Prince at Flushing, New York. This tree had not borne fruit, and Wangenheim's figure probably represented a peanut. The Pecan does not seem to have been known on the Atlantic seaboard before 1762, when some of the nuts were carried to New York by fur-traders from the Mississippi valley. In 1772 William Prince planted thirty nuts and succeeded in raising ten plants, eight of which he sold in England for ten guineas each (Brendel, *Am. Nat.* xiii. 757).

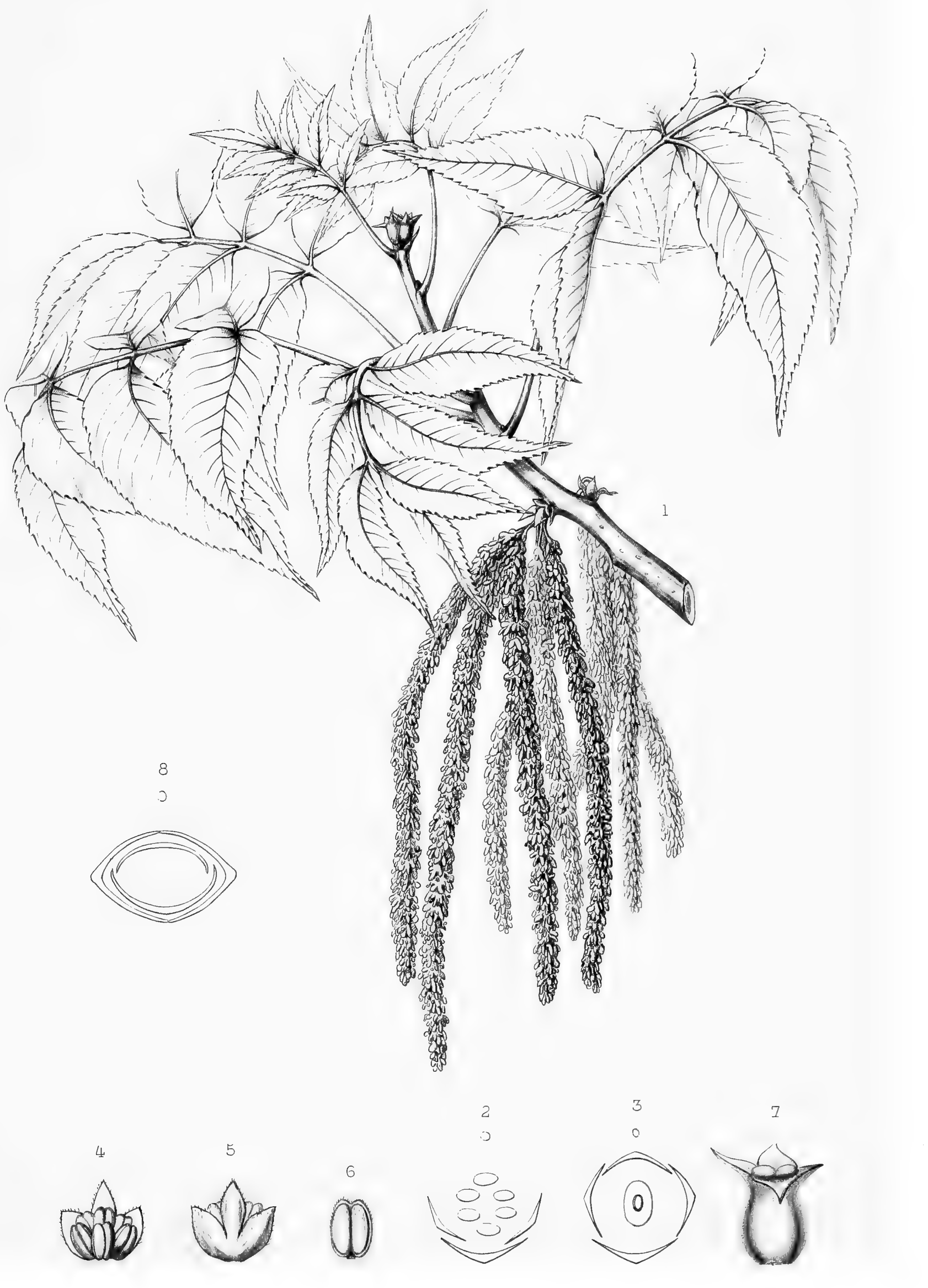
EXPLANATION OF THE PLATES.

Plate CCCXXXVIII. Hicoria Pecan.

1. A flowering branch, natural size.
2. Diagram of a staminate flower.
3. Diagram of a pistillate flower.
4. A staminate flower, front view, enlarged.
5. A staminate flower, rear view, enlarged.
6. A stamen, enlarged.
7. A pistillate flower, enlarged.
8. Diagram of a winter-bud.

Plate CCCXXXIX. Hicoria Pecan.

1. A fruiting branch, natural size.
2. A nut, natural size.
3. A nut, natural size.
4. A nut, natural size.
5. Cross section of a nut, natural size.
6. A thin-shelled nut cut transversely, natural size.
7. A leaf, reduced.
8. A winter branchlet, natural size.



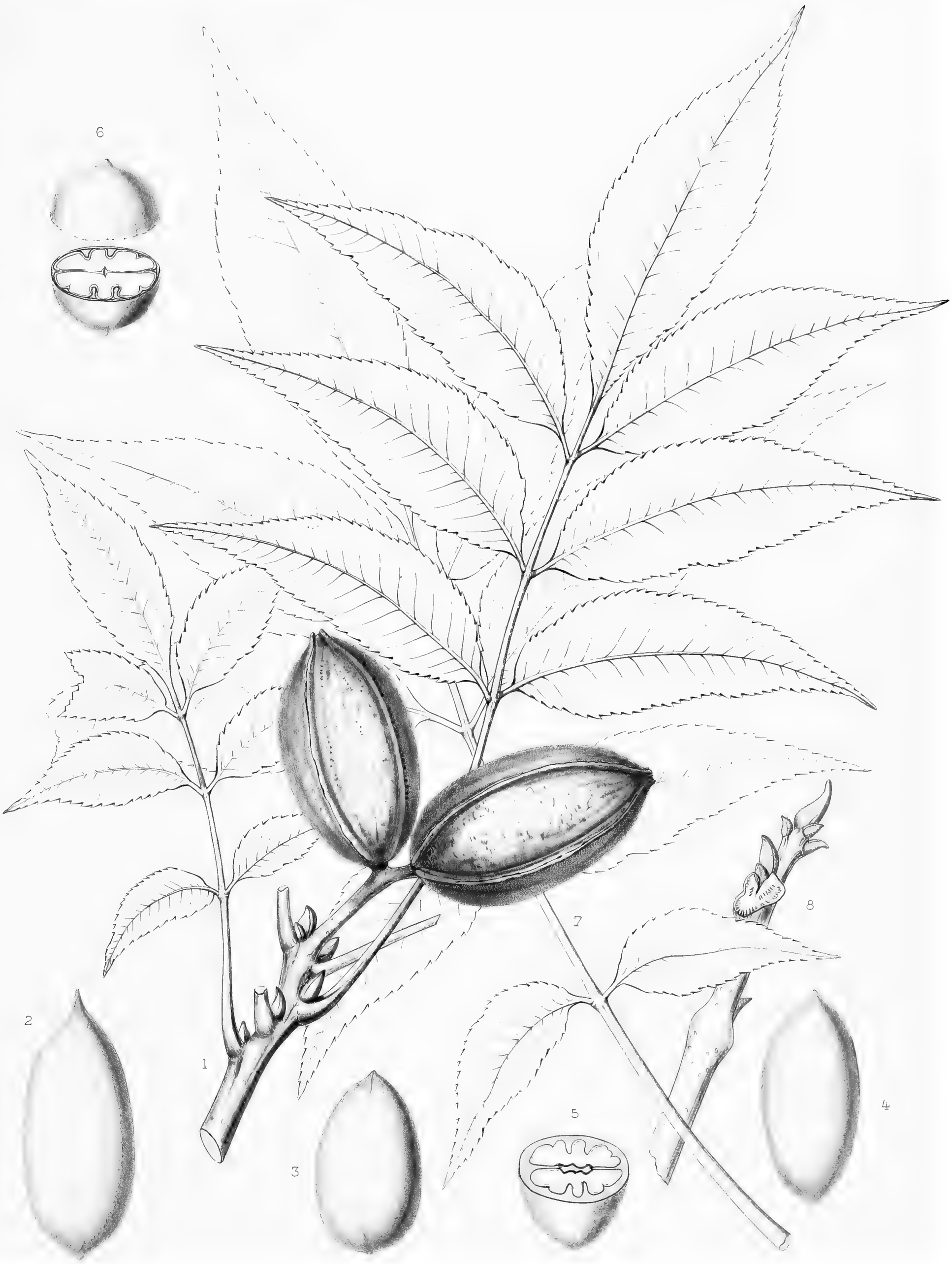
C.E. Faxon del.

Himely sc.

HICORIA PECAN, Britt.

A. Riocreux direx.t

Imp. J. Taneur, Paris.



C.E.Faxon del. *Himely sc.*

HICORIA PECAN, Britt.

A.Riocreux direx.t *Imp. J. Taneur, Paris.*

HICORIA MINIMA.

Bitternut. Swamp Hickory.

LEAFLETS 5 to 9, lanceolate to oblong-lanceolate. Fruit 4-winged from the apex nearly to the middle; nut ovate or oblong, often broader than long, thin-shelled; kernel bitter. Winter buds bright yellow.

Hicoria minima, Britton, *Bull. Torrey Bot. Club*, xv. 284 (1888). — Dippel, *Handb. Laubholzk.* ii. 337, f. 154. — Koehne, *Deutsche Dendr.* 73, f. 23 F. F′. — Coulter, *Contrib. U. S. Nat. Herb.* ii. 411 (*Man. Pl. W. Texas*).

Juglans alba minima, Marshall, *Arbust. Am.* 68 (1785). — Castiglioni, *Viag. negli Stati Uniti*, ii. 262.

Juglans cordiformis, Wangenheim, *Nordam. Holz.* 25, t. 10, f. 25 (1787).

Juglans angustifolia, Poiret, *Lam. Dict.* iv. 504 (not Aiton) (1797). — Du Mont de Courset, *Bot. Cult.* ed. 2, vi. 236.

Juglans sulcata, Willdenow, *Berl. Baumz.* 154 (1796); *Spec.* iv. 457. — Borkhausen, *Handb. Forstbot.* i. 758. — Muehlenberg & Willdenow, *Neue Schrift. Gesell. nat. Fr. Berlin*, iii. 391. — Persoon, *Syn.* ii. 566. — Desfontaines, *Hist. Arb.* ii. 348.

Juglans minima, Borkhausen, *Handb. Forstbot.* i. 760 (1800).

Juglans mucronata, Michaux, *Fl. Bor.-Am.* ii. 192 (1803).

Juglans amara, Michaux f. *Hist. Arb. Am.* i. 177, t. 4 (1810). — Pursh, *Fl. Am. Sept.* ii. 638.

Carya amara, Nuttall, *Gen.* ii. 222 (1818). — Elliott, *Sk.* ii. 626. — Sprengel, *Syst.* iii. 849. — Spach, *Hist. Vég.* ii. 177. — Hooker, *Fl. Bor.-Am.* ii. 144. — Torrey, *Fl. N. Y.* ii. 183. — Emerson, *Trees Mass.* 199, t. 15. — Darlington, *Fl. Cestr.* ed. 3, 264. — Curtis, *Rep. Geolog. Surv. N. Car.* 1860, iii. 44. — Chapman, *Fl.* 419. — C. de Candolle, *Ann. Sci. Nat.* sér. 4, xviii. 36, t. 1, f. 2, t. 5, f. 55; *Prodr.* xvi. pt. ii. 144. — Koch, *Dendr.* i. 592. — Lauche, *Deutsche Dendr.* 308. — Ridgway, *Proc. U. S. Nat. Mus.* 1882, 77. — Sargent, *Forest Trees N. Am. 10th Census U. S.* ix. 135. — Watson & Coulter, *Gray's Man.* ed. 6, 469. — Mayr, *Wald. Nordam.* 160, t. 4.

Hicorius amara, Rafinesque, *Fl. Ludovic.* 109 (1827).

Hicorius minimus, Sargent, *Garden and Forest*, ii. 460 (1889).

A tree, often one hundred feet in height, with a tall straight trunk two to three feet in diameter, and stout spreading limbs which form a broad handsome head of slender rather stiff upright branches; or toward the northern and southern limits of its range much smaller. The bark of the trunk is from one third to three quarters of an inch in thickness, light brown tinged with red, and broken into thin plate-like scales, their surface separating in small thin flakes. The branchlets are slender and marked with oblong pale lenticels, and when they first appear are bright green and covered more or less thickly with rusty hairs which soon disappear; during their first summer they are reddish brown and glabrous or puberulous; during the winter they are reddish or orange-brown and lustrous, with small elevated obscurely three-lobed obcordate leaf-scars, and are often covered toward the apex with the clusters of bright yellow articulate hairs that likewise clothe the buds and the fruit; in the second year they grow gradually darker and ultimately are light gray. The terminal buds are from one third to three quarters of an inch long, compressed, oblique at the apex, and covered by two pairs of scales, the outer pair being ovate or obovate, rounded and reticulate or sometimes obscurely pinnate at the apex, yellow-green and puberulous on the inner surface, while the inner pair are strap-shaped, pinnate at the apex, coated on the back with rufous tomentum, and sprinkled with golden glands, reflexed and an inch and a half long at maturity, resembling in their broad flat stalks and in their covering the first pair of leaves. The lateral buds are compressed, slightly four-angled, often stalked, and from one eighth to one quarter of an inch in length, with ovate pointed scales keeled on the back, pubescent on the inner surface, slightly accrescent and reflexed after the opening of the bud. The leaves are composed of from five to nine leaflets and slender pubescent or hirsute slightly grooved petioles, and are from six to ten inches long; the leaflets, which increase in size from the base to the apex of the leaf, are lanceolate to oblong or ovate-

lanceolate, or obovate, long-pointed, and rather coarsely serrate with reflexed callous teeth except at the base, which is equally or unequally wedge-shaped or subcordate, and are sessile with the exception of the terminal leaflet, which is gradually narrowed into a long or short petiolule; when they unfold they are lustrous, bright yellow-green or bronzy red, pubescent above and coated below with pale tomentum and lustrous golden often persistent glands; and at maturity they are thin and firm, dark yellow-green and glabrous on the upper surface, and on the lower surface lighter and glabrous or pubescent, especially along the midribs, or coated with golden glands, from four to six inches in length and from three quarters of an inch to an inch and a quarter in width, with narrow rounded pale midribs and slender primary veins, or those of the lowest pair are often not more than half this size. The catkins of staminate flowers are usually produced from branches of the previous year, but sometimes from the base of shoots of the year; they are slightly pubescent, and from three to four inches long, with a slender peduncle often an inch in length, and lanceolate acute bracts rounded and boat-shaped on the back, coated with long rusty hairs, and half an inch in length. Before they unfold the buds of the staminate flowers are flattened, green, glandular with scattered pale glands, and covered toward the apex with long slender pale rufous hairs; the bract is ovate, acute, twice as long as the lobes of the calyx, and, like them, coated on the outer surface with scattered rufous hairs; there are four stamens with ovate yellow anthers deeply emarginate at the apex and about as long as the lobes of the calyx. The pistillate flowers are half an inch in length, slightly four-angled, and covered with yellow scurfy tomentum; the bract is lanceolate, acute, hairy at the margins, and coated on the inner surface with soft pale hairs; the bractlets are broadly ovate, acute, thin and spreading, hairy-pubescent on the inner surface, and rather shorter than the acute calyx-lobe; the stigmas, which mature and begin to wither before the staminate flowers open, are exserted and reflexed at maturity, as long as the bract, and light green. The fruit is three quarters of an inch to an inch and a half long, obovate to subglobose, and four-winged from the apex to about the middle, with a husk an eighth of an inch thick or less, more or less thickly covered on the outer surface with golden scurfy pubescence, and conspicuously marked on the light brown inner surface with dark veins radiating from the base. The nut is ovate or oblong, often broader than long, compressed, rounded, and marked at the base with dark lines along the sutures and alternate with them, depressed or obcordate and abruptly contracted into a long or short point at the apex, gray tinged with red or light reddish brown, and irregularly and coarsely reticulate on the surface, with a thin or rarely with a thick brittle shell which contains numerous large lacunæ, and, like the thin rugose partitions of the interior, is dark reddish brown and very rugose on the inner surface. The seed is compressed, with flat cotyledons, rounded and deeply two-parted at the base, rounded and lobed at the apex, the lobes being as long or longer than their short-pointed connective, deeply rugose with irregular cross folds, covered with a bright reddish brown coat, and very bitter.

Hicoria minima is distributed from southern Maine to the islands of the St. Lawrence near the mouth of the Nicolet River, westward from the neighborhood of Montreal through Ontario,[1] central Michigan and Minnesota to southeastern Nebraska,[2] eastern Kansas,[3] and the Indian Territory, and southward to the valley of the Appalachicola River in western Florida and to that of the Trinity River in Texas. An inhabitant of low wet woods near the borders of streams and swamps or of high rolling uplands, *Hicoria minima*, which reaches a higher latitude than any other Hickory-tree, is the most abundant species in Canada, where it is common south and west of Montreal, growing usually in low ground, and in the western part of Ontario is one of the principal trees of the forest. Absent from the mountain forests of northern New England and New York, in southern New England it is one of the largest and commonest species of the genus, and is often found remote from streams; it abounds in all the central states east and west of the Appalachian Mountains, growing to its largest size on the

[1] Brunet, *Cat. Vég. Lig. Can.* 47. — Bell, *Geolog. Rep. Can.* 1879–80, 52°. — Macoun, *Cat. Can. Pl.* 434.

[2] Bessey, *Rep. Nebraska State Board Agric.* 1894, 109.

[3] Mason, *Distribution of Kansas Trees*, 13.

rich bottom-lands of the lower Ohio Basin;[1] it is rare on the south Atlantic seaboard, and probably does not reach the coast of the Gulf of Mexico, but north of the coast Pine-belt in Alabama and Mississippi it is the most multiplied species on the poor dry gravelly soil of the uplands;[2] in Iowa and Nebraska it is the commonest species; it is very abundant in Kansas, growing farther west in that state than any other Hickory-tree, but gradually becomes rarer in southern Arkansas and in Texas.

The wood of *Hicoria minima* is heavy, very hard, strong, tough, and close-grained, with numerous obscure medullary rays and bands of several rows of large open ducts marking the layers of annual growth. It is dark brown, with thick light brown or often nearly white sapwood. The specific gravity of the absolutely dry wood is 0.7552, a cubic foot weighing 47.06 pounds. It is largely used for hoops and ox-yokes, and for fuel.

Hicoria minima was not distinguished by the early European travelers and botanists in North America, who usually confounded the different species of Hickory; and the first mention of it appears in Marshall's *Arbustum Americanum*, published in 1785. According to Loudon,[3] it was introduced into English gardens in 1800.

The noble size of the Bitternut, its strong trunk covered with close bright bark, and its handsome head, make it at all seasons of the year one of the most beautiful trees of the northern forest. In cultivation it grows more rapidly than the other Hickories,[4] with the exception of the Pecan, and, still little known or appreciated by planters it might more often be used with advantage for the decoration of parks and pleasure-grounds.

[1] Ridgway, *Proc. U. S. Nat. Mus.* 1882, 77.

[2] On this southern upland tree the nut is often unusually thick-shelled, and is covered with a thick husk.

[3] *Arb. Brit.* iii. 1443, f. 1264.

[4] All the species of Hicoria grow slowly. The log specimen of *Hicoria minima* in the Jesup Collection of North American Woods in the American Museum of Natural History, New York, from Missouri, is fourteen inches in diameter inside the bark, with one hundred and nine layers of annual growth, twenty-two of which are sapwood.

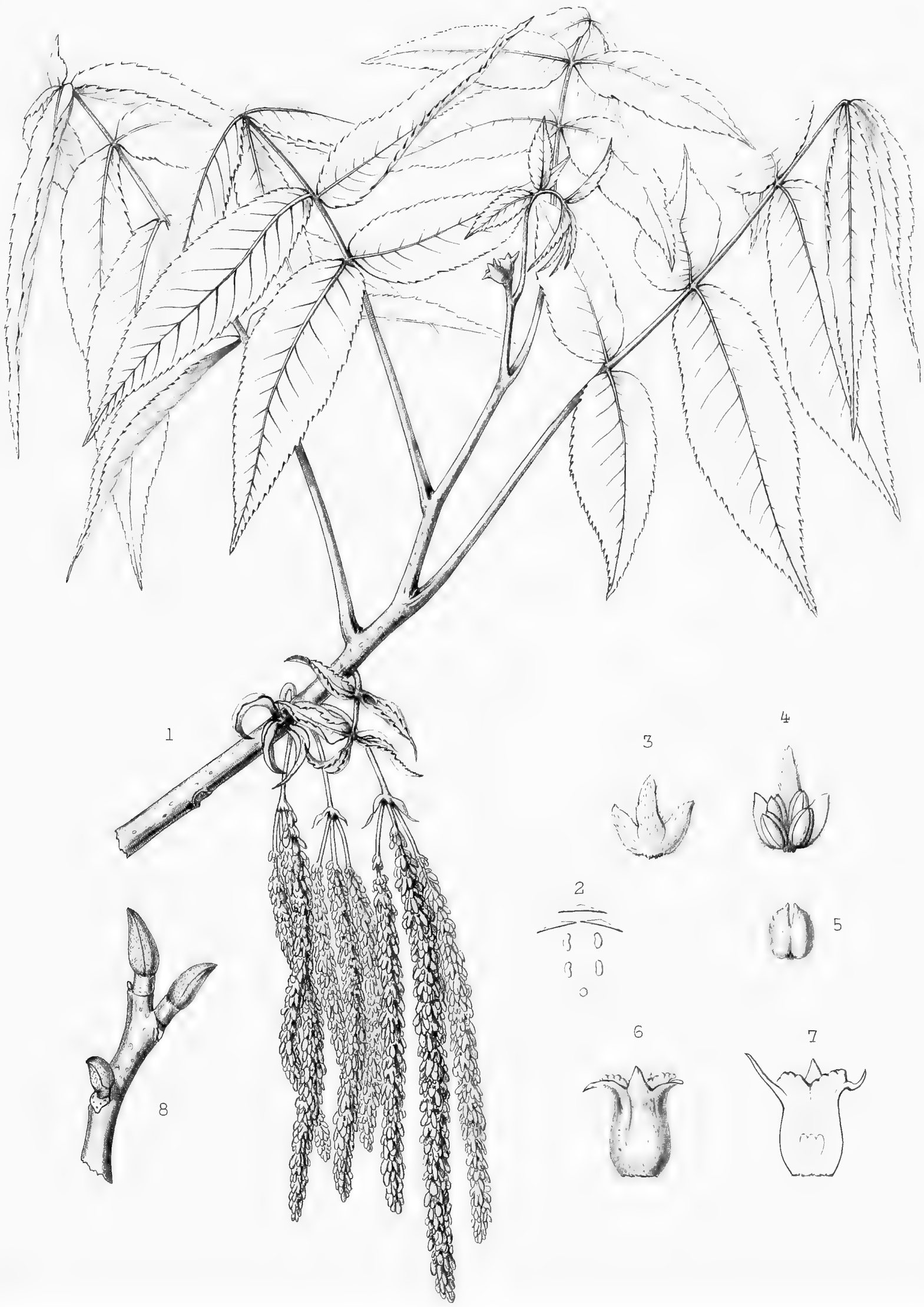
EXPLANATION OF THE PLATES.

PLATE CCCXL. HICORIA MINIMA.

1. A flowering branch, natural size.
2. Diagram of a staminate flower.
3. A staminate flower, rear view, enlarged.
4. A staminate flower, front view, enlarged.
5. A stamen, enlarged.
6. A pistillate flower, side view, enlarged.
7. Vertical section of a pistillate flower, enlarged.
8. A winter branchlet, natural size.

PLATE CCCXLI. HICORIA MINIMA.

1. A fruiting branch, natural size.
2. A nut, natural size.
3. Cross section of a nut, natural size.
4. Vertical section of a nut, natural size.
5. An embryo, natural size.



C.E. Faxon del. Himely sc.

HICORIA MINIMA, Britt.

A. Riocreux direx.t Imp J. Taneur, Paris.

C.E.Faxon del. *Himely sc.*

HICORIA MINIMA, Britt.

A.Riocreux direx.t *Imp. J. Taneur, Paris.*

HICORIA MYRISTICÆFORMIS.

Nutmeg Hickory.

LEAFLETS 5 to 11, ovate-lanceolate to oblong-obovate, pale and lustrous on the lower surface. Fruit ellipsoidal, conspicuously 4-winged to the base; nut ellipsoidal, thick-shelled; kernel sweet.

Hicoria myristicæformis, Britton, *Bull. Torrey Bot. Club*, xv. 284 (1888). — Coulter, *Contrib. U. S. Nat. Herb.* ii. 411 (*Man. Pl. W. Texas*).

Juglans myristicæformis, Michaux f. *Hist. Arb. Am.* i. 211, t. 10 (1810). — Pursh, *Fl. Am. Sept.* ii. 638. — Poiret, *Lam. Dict.* Suppl. iv. 112. — Rafinesque, *Fl. Ludovic.* 161.

Carya myristicæformis, Nuttall, *Gen.* ii. 222 (1818). — Elliott, *Sk.* ii. 628. — Sprengel, *Syst.* iii. 849. — Spach, *Hist. Vég.* ii. 179. — Loudon, *Arb. Brit.* iii. 1451, f. 1275. — Chapman, *Fl.* 419. — C. de Candolle, *Ann. Sci. Nat.* sér. 4, xviii. 36, t. 6, f. 58; *Prodr.* xvi. pt. ii. 145. — Koch, *Dendr.* i. 595. — Lauche, *Deutsche Dendr.* 308. — Sargent, *Forest Trees N. Am.* 10*th Census U. S.* ix. 135. — Mayr, *Wald. Nordam.* 162, t. 4.

Carya amara, var.? **myristicæformis**, Cooper, *Smithsonian Rep.* 1858, 255.

Hicorius myristicæformis, Sargent, *Garden and Forest*, ii. 460 (1889).

Hicoria Fernowiana, Sudworth, *Trees of Washington*, (1891).

A tree, eighty to one hundred feet in height, with a tall straight trunk often two feet in diameter and stout slightly spreading branches which form a comparatively narrow rather open head. The bark of the trunk is from one half to three quarters of an inch thick, dark brown tinged with red, and broken irregularly into small thin appressed scales. The branchlets are slender and are coated at first with lustrous golden or brown peltate scales which often do not entirely disappear until the second year; during their first winter they are light brown or ashy gray and marked with small scattered pale lenticels and small oval emarginate elevated leaf-scars, and in their second year they become dark reddish brown. The terminal buds are from an eighth to a quarter of an inch long, broadly ovate and rather obtuse, the outer scales being coated with thick brown scurfy pubescence and soon splitting so that the inner scales, which are covered with thick pale tomentum, are displayed; the axillary buds are much smaller and are acute, slightly flattened, sessile or short-stalked, and often solitary. The leaves are composed of from five to eleven leaflets and of slender terete or slightly grooved scurfy-pubescent petioles, and are from seven to fourteen inches in length; the leaflets are ovate-lanceolate or the upper ones, which are usually twice as large as those at the base of the leaf, are broadly obovate; they are acute with short or elongated points at the apex, usually equally or sometimes unequally wedge-shaped or rounded at the narrow base, coarsely serrate with remote incurved teeth, and short-petiolulate or nearly sessile, the terminal leaflet being decurrent on a broad stalk rarely half an inch long; when they unfold they are coated with scurfy brown pubescence on the lower surface and are covered on the upper by circular more or less persistent clusters of brown scales; at maturity they are thin and firm, dark green above, and below are more or less pubescent or nearly glabrous and silvery white and very lustrous, changing late in the season to bright bronzy brown; they are four or five inches in length and from an inch to an inch and a half in breadth, with pale midribs scurfy-pubescent on both sides and numerous straight primary forked veins and thin cross-veinlets. The catkins of the staminate flowers, which are three or four inches long and are coated, like the bract and calyx of the flower, with dark brown scurfy pubescence, have a common peduncle three quarters of an inch long and linear-lanceolate lateral bracts half an inch in length; the bract of the flower is ovate-oblong, acute and about twice as long as the broadly ovate rounded lobes of the calyx; there are six stamens with oblong emarginate

anthers. The female flower is oblong, narrowed at both ends, slightly four-angled and covered with thick brown scurfy pubescence; the bract is elongated, lanceolate, acute, and twice as long as the ovate acute bractlets and the calyx-lobe. The fruit, which is usually solitary on the branch, is ellipsoidal or slightly obovate, four-ridged to the base with broad thick ridges, about an inch and a half long, and coated on the outer surface with yellow or brown scurfy pùbescence; the husk is not more than one thirty-second of an inch thick, and in opening splits nearly to the base. The nut is ellipsoidal or sometimes slightly obovate, an inch long, three quarters of an inch broad, rounded and apiculate at both ends, smooth, dark reddish brown and marked with irregular longitudinal broken bands of small gray spots which often cover the entire surface at the ends. It has a very hard bony shell one eighth of an inch thick or more, with a thick dissepiment separating the cotyledons, a low thin dorsal dissepiment and a small sweet seed with two deep longitudinal grooves on the outer surface of the thick cotyledons, a short broad connective, and a dark brown testa.

Hicoria myristicæformis inhabits the banks of rivers and swamps, growing in rich moist soil or sometimes on higher ground at a considerable distance above the stream. It is rare and very local in the coast region of South Carolina;[1] it occurs in the cretaceous belt of central Alabama[2] between the Tombigbee and Alabama Rivers, where it grows with *Hicoria Pecan* and *Quercus Durandii*, and in central Mississippi;[3] and it is common in southern Arkansas[4] and on the Sierra Madre Mountains of northeastern Mexico.[5]

The wood of *Hicoria myristicæformis* is heavy, hard, very strong, tough, and close-grained, and contains numerous thin inconspicuous medullary rays, many small open ducts and bands of one or two rows of larger ducts marking the layers of annual growth. It is light brown, with thick lighter colored sapwood composed of eighty or ninety layers of annual growth. The specific gravity of the absolutely dry wood is 0.8016, a cubic foot weighing 49.96 pounds.

Hicoria myristicæformis, which, before the exploration of the forests of southern Arkansas, was considered one of the rarest trees of eastern America, was first made known by the younger Michaux, to whom nuts found in the swamps of Goose Creek, fifteen or twenty miles west of Charleston in South Carolina, were given in 1802. The lustrous under surface of the leaves makes it perhaps the most beautiful of the Hickories, and, although it is now rarely cultivated, it might well find a place as an ornamental tree in the gardens and parks of temperate countries.[6]

[1] In South Carolina *Hicoria myristicæformis* grows on Goose Creek, where the species was first discovered, and in the valley of the Cooper River not far from Black Oak on the Santee Canal (Ravenel, *Bull. Torrey Bot. Club*, vi. 81).

[2] In Alabama, where it was discovered in 1890 by Dr. Charles Mohr, *Hicoria myristicæformis* grows on low limestone prairies, occupying a narrow belt eighteen or twenty miles long from west to east, which extends from Demopolis on the Tombigbee River to Gallion near the Alabama (Mohr, *Garden and Forest*, vi. 372).

[3] The existence of this tree in Mississippi was first made known by the exhibition of a quantity of the nuts in the exhibit of that state at the New Orleans Exposition of 1884, but it was not until the autumn of 1894 that it was found by Dr. Charles Mohr abounding and growing to its largest size in thick forests on calcareous soil in the neighborhood of Mhoons Valley in the central part of the state.

[4] In Arkansas *Hicoria myristicæformis* is common in the southeastern part of the state between Pine Bluff on the Arkansas River, where it was found in 1881 by Mr. George W. Letterman, and Arkansas City on the Mississippi, and along the Red River bottoms above Fulton in the southwestern part of the state (Harvey, *Am. Jour. Forestry*, i. 453).

[5] *Hicoria myristicæformis* was discovered in cañons of the Sierra Madre Mountains near Monterey, in Nuevo Leon, by Mr. C. G. Pringle, in July, 1888, covering rocky slopes almost to the exclusion of other trees (Pringle, *Garden and Forest*, iii. 362).

[6] A Nutmeg-Hickory tree, which has been growing for many years in the garden of the Department of Agriculture, in Washington, is now about twenty-five feet high.

EXPLANATION OF THE PLATES.

PLATE CCCXLII. HICORIA MYRISTICÆFORMIS.

1. A flowering branch, natural size.
2. A staminate flower, rear view, enlarged.
3. A staminate flower, front view, enlarged.
4. A stamen, enlarged.
5. A pistillate flower, lateral view, enlarged.
6. A winter branchlet, natural size.

PLATE CCCXLIII. HICORIA MYRISTICÆFORMIS.

1. A fruiting branch, natural size.
2. A nut, natural size.
3. Vertical section of a nut, natural size.

C E. Faxon del. Himely sc.

HICORIA MYRISTICÆFORMIS, Britt.

A. Riocreux direx.t Imp. J. Taneur, Paris.

C.E.Faxon del. Himely sc.

HICORIA MYRISTICÆFORMIS, Britt.

A. Riocreux direx.t Imp J. Taneur, Paris

HICORIA AQUATICA.

Bitter Pecan. Water Hickory.

LEAFLETS 7 to 13, ovate-lanceolate, often falcate. Fruit compressed, 4-winged to the base; nut flattened, 4-ridged, rugose, thin-shelled; kernel bitter.

Hicoria aquatica, Britton, *Bull. Torrey Bot. Club*, xv. 284 (1888). — Dippel, *Handb. Laubholzk.* ii. 338, f. 155. — Koehne, *Deutsche Dendr.* 73. — Coulter, *Contrib. U. S. Nat. Herb.* ii. 411 (*Man. Pl. W. Texas*).

Juglans aquatica, Michaux f. *Hist. Arb. Am.* i. 182, t. 5 (1810). — Pursh, *Fl. Am. Sept.* ii. 638. — Poiret, *Lam. Dict.* Suppl. iv. 112.

Hicorius integrifolia, Rafinesque, *Fl. Ludovic.* 109 (1817).

Carya aquatica, Nuttall, *Gen.* ii. 222 (1818). — Elliott, *Sk.* ii. 627. — Sprengel, *Syst.* iii. 849. — Spach, *Hist. Vég.* ii. 179. — Loudon, *Arb. Brit.* iii. 1444, f. 1265, 1266. — Scheele, *Roemer Texas*, 447. — Curtis, *Rep. Geolog. Surv. N. Car.* 1860, iii. 44. — Chapman, *Fl.* 419. — C. de Candolle, *Ann. Sci. Nat.* sér. 4, xviii. 36, t. 1, f. 4, t. 5, f. 53, 56, 57; *Prodr.* xvi. pt. ii. 144. — Koch, *Dendr.* i. 593. — Sargent, *Forest Trees N. Am.* 10*th Census U. S.* ix. 135. — Mayr, *Wald. Nordam.* 162, t. 4.

Carya integrifolia, Sprengel, *Syst.* iii. 849 (1826). — Loudon, *Arb. Brit.* iii. 1451.

Hicorius aquaticus, Sargent, *Garden and Forest*, ii. 460 (1889).

A tree, occasionally eighty to one hundred feet in height, with a trunk rarely exceeding two feet in diameter, and slender upright branches which form a narrow head; or usually much smaller. The bark of the trunk is from one half to two thirds of an inch thick and separates freely into long loose plate-like light brown scales tinged with red. The branchlets are slender, dark reddish brown or ashy gray, lustrous and marked with numerous pale lenticels; when they first appear they are slightly glandular and coated with loose caducous pale tomentum; they become glabrous or puberulous during the summer, are marked during the winter with small nearly oval or obscurely three-lobed slightly elevated leaf-scars, and in their second year grow dark brown, ultimately turning gray. The buds are slightly flattened, acute, dark reddish brown, and clothed with caducous yellow glands. The terminal bud, which varies from an eighth to a quarter of an inch in length and is often covered, especially while young, with pale scattered hairs, is about twice as large as the axillary buds, which are often solitary and frequently nearly sessile. The leaves are composed of from seven to thirteen leaflets, which increase slightly in size from the lowest to the uppermost, and slender dark red puberulous or tomentose terete petioles, and vary from nine to fifteen inches in length; the leaflets are ovate-lanceolate, long-pointed, falcate, equilateral, and gradually rounded or wedge-shaped at the base, or oblique and very unequally wedge-shaped, or with one side rounded and the other wedge-shaped at the base; they are serrate with minute remote teeth or conspicuously and coarsely serrate, and sessile or petiolulate, the terminal leaflet, which is sometimes obovate and rarely rounded at the apex, being more or less decurrent by its regular wedge-shaped base on a slender stalk often nearly an inch long, or rarely nearly sessile; when they unfold they are coated, like the petioles, with pale tomentum and covered with yellow persistent glandular dots, and at maturity are from three to five inches in length, from half an inch to an inch and a half in width, thin and membranaceous, dark green on the upper surface, and on the under surface brown and rather lustrous and more or less pubescent or tomentose, especially along the slender midribs, which are also tomentose on the upper side, and along the slender primary veins connected by finely reticulate veinlets. The catkins of staminate flowers, which appear when the leaves are about a third grown, are solitary or fascicled and are produced from separate or sometimes from leaf-bearing buds on branches of the previous year and at the base of branches of the year; they are hirsute and from two and one half to three inches long, with common peduncles one third of an inch in length and ovate-lanceolate

scarious caducous lateral bracts sometimes nearly an inch long; the bract of the flower is elongated, obovate, rounded at the apex and coated on the outer surface, like the shorter calyx-lobes, with yellow glandular pubescence; there are six stamens with oblong slightly emarginate light yellow anthers. The female flower is oblong, slightly flattened and four-angled, and covered with glandular pubescence; the bract is linear-lanceolate, acute and about twice as long as the broad nearly triangular acute bractlets and the acute calyx-lobe. The fruit, which is often in three or four-fruited clusters, is much compressed, usually broadest above the middle, rounded at the slightly narrowed base, rounded and abruptly narrowed at the apex into a short thick point, conspicuously four-winged, dark brown or nearly black and covered more or less thickly with bright yellow pubescence, from an inch to an inch and a half long and from an inch to an inch and a quarter wide, with a very thin and brittle husk which splits tardily and usually only to the middle. The nut is flattened, slightly obovate, from an inch to an inch and a half in length and often as much in breadth, rounded and abruptly sharp-pointed or umbonate at the apex, rounded at the narrow base, four-angled and ridged, the ridges which alternate with the sutures being much broader and more developed than the others, dark reddish brown and longitudinally and very irregularly rugose. The walls and partitions of the cavity are thin, with large and very irregular lacunæ filled with a dark red bitter powder. The seed is oblong, compressed, two-lobed to above the middle, covered by a dark brown testa and very irregularly and mostly longitudinally furrowed, with cotyledons which are divided from the base for about one third of their length by the thin dorsal partition.

Hicoria aquatica, the smallest and least valuable of the Hickory-trees, is an inhabitant of low river-swamps often inundated during a considerable part of the year, where it is associated with the Water Ash, the Sweet Gum, the Red Maple, the Cotton Gum, the Bald Cypress, and other water-loving trees. It is distributed from the neighborhood of Mobjack Bay in Virginia [1] south through the coast region to Cape Malabar and the valley of the Caloosa River in Florida, and through the maritime portions of the Gulf states to the valley of the Brazos River in Texas, ranging north through western Louisiana to northeastern Arkansas, eastern Mississippi, and southern Illinois.[2] Comparatively rare in the south Atlantic states, and seldom if ever approaching within fifteen or twenty miles of the coast, the Bitter Pecan is most abundant and grows to its largest size in the swamps of western Mississippi, Arkansas, and Louisiana.

The wood of *Hicoria aquatica* is heavy, strong, and close-grained, although soft and rather brittle, and contains numerous thin medullary rays, occasional scattered open ducts and obscure bands of similar ducts marking the layers of annual growth; it is dark brown, with thick bright-colored or often nearly white sapwood. The specific gravity of the absolutely dry wood is 0.7407, a cubic foot weighing 46.16 pounds. It is sometimes used for fencing and fuel, although it is difficult to obtain an account of the inaccessibility of the situations inhabited by this tree.

The Bitter Pecan was first distinguished in Louisiana by the French traveler Robin.[3] Introduced into France by the younger Michaux, it is now exceedingly rare in cultivation, or, perhaps, has entirely disappeared from gardens.

[1] *Hicoria aquatica* was collected near Mobjack Bay by Mr. W. H. Leggett, of New York, on August 7, 1875 (teste Herb. Columbia College).

[2] *Hicoria aquatica* was collected in 1883 near Equality, Gallatin County, Illinois, by Mr. W. F. Fortune (teste Herb. Columbia College). It is included with *Hicoria myristiciæformis* in the list of trees noticed by Maximilian, Prinz von Wied, growing near New Harmony, Indiana, during his visit there in 1832 (*Reise in das Innere von Nord-Amerika*, i. 209).

[3] *Voyages*, iii. 511 (1807).

EXPLANATION OF THE PLATES.

Plate CCCXLIV. Hicoria aquatica.

1. A flowering branch, natural size.
2. A staminate flower, front view, enlarged.
3. A staminate flower, rear view, enlarged.
4. A stamen, enlarged.
5. A pistillate flower, lateral view, enlarged.
6. A winter branchlet, natural size.

Plate CCCXLV. Hicoria aquatica.

1. A fruiting branch, natural size.
2. A fruit, natural size.
3. A nut, natural size.
4. Cross section of a nut, natural size.
5. A nut, natural size.
6. A leaf, natural size.

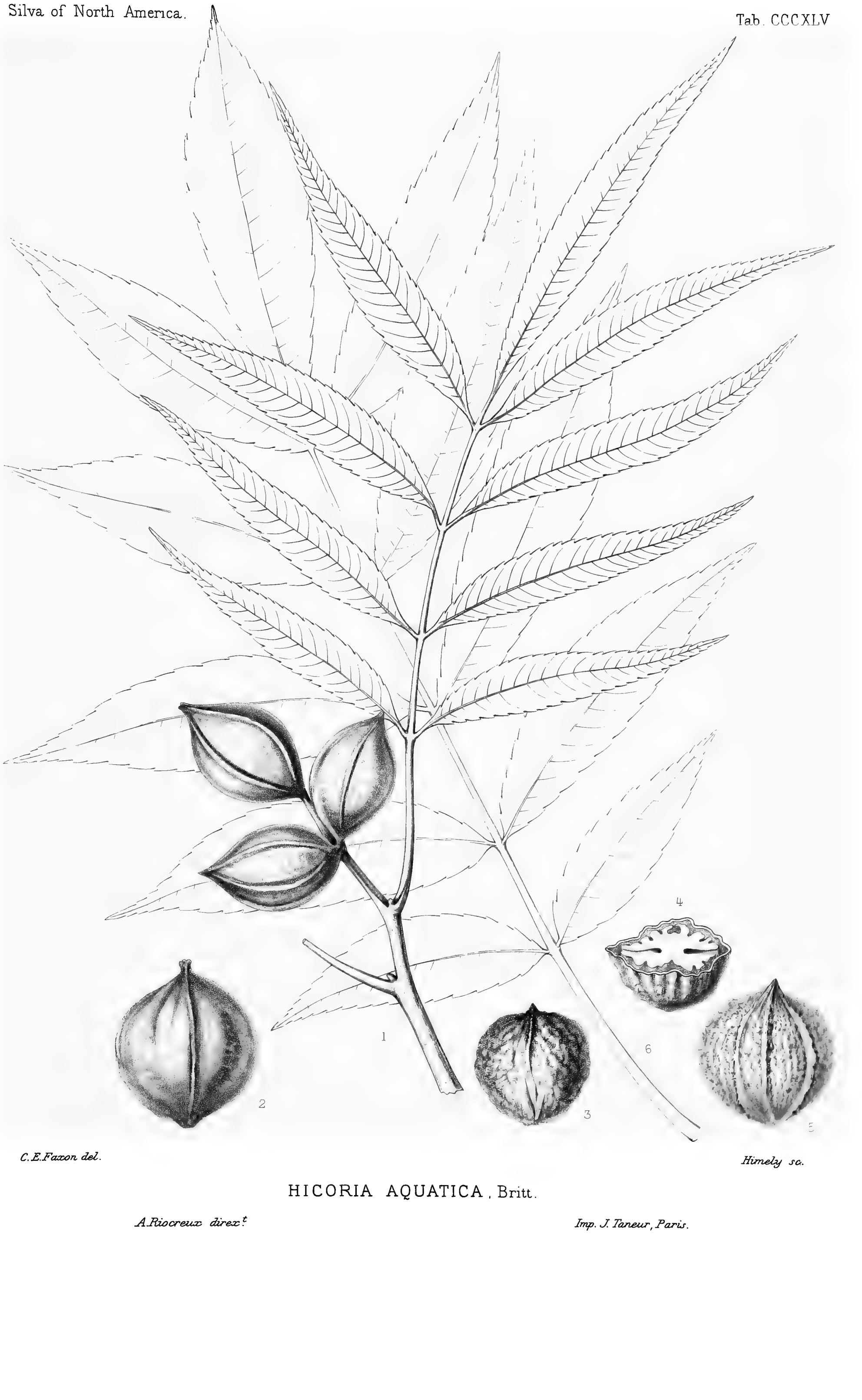
C.E.Faxon del.

Himely sc.

HICORIA AQUATICA, Britt.

A.Riocreux direx.t

Imp. J.Taneur, Paris



C.E.Faxon del.

Himely sc.

HICORIA AQUATICA, Britt.

A.Riocreux direx.t

Imp. J. Taneur, Paris.

HICORIA OVATA.

Shellbark Hickory. Shagbark Hickory.

LEAFLETS 5 or 7, obovate to oblong-lanceolate, ciliate on the margins. Fruit globose, depressed at the apex; nut ovate, more or less flattened, 4-angled, thin or thick-shelled, pale or nearly white.

Hicoria ovata, Britton, *Bull. Torrey Bot. Club*, xv. 283 (1888). — Dippel, *Handb. Laubholzk.* ii. 335. — Koehne, *Deutsche Dendr.* 72, f. 22 C. C′. C″.

Juglans ovata, Miller, *Dict.* ed. 8, No. 6 (1768).

Juglans alba ovata, Marshall, *Arbust. Am.* 69 (1785). — Castiglioni, *Viag. negli Stati Uniti*, ii. 262. — Borkhausen, *Handb. Forstbot.* i. 762.

Juglans ovalis, Wangenheim, *Nordam. Holz.* 24, t. 10, f. 23 (1787).

Juglans compressa, Gærtner, *Fruct.* ii. 51, t. 89, f. 1 (1791). — Muehlenberg & Willdenow, *Neue Schrift. Gesell. nat. Fr. Berlin*, iii. 390. — Willdenow, *Spec.* iv. 458; *Enum.* 979; *Berl. Baumz.* ed. 2, 195. — Persoon, *Syn.* ii. 566. — Desfontaines, *Hist. Arb.* ii. 347. — Aiton, *Hort. Kew.* ed. 2, v. 297. — Hayne, *Dendr. Fl.* 164. — Poiret, *Lam. Dict.* iii. 365, t. 781, f. 3.

Juglans alba, Michaux, *Fl. Bor.-Am.* ii. 193 (not Linnæus) (1803). — Pursh, *Fl. Am. Sept.* ii. 637. — Du Mont de Courset, *Bot. Cult.* ed. 2, vi. 235.

Juglans obcordata, Poiret, *Lam. Dict.* iv. 504 (1797).

Juglans squamosa, Michaux f. *Hist. Arb. Am.* i. 190, t. 7 (not Poiret) (1810). — Bigelow, *Fl. Boston.* 229.

Carya alba, Nuttall, *Gen.* ii. 221 (1818). — Elliott, *Sk.* ii. 624. — Sprengel, *Syst.* iii. 849. — Spach, *Hist. Vég.* ii. 174. — Loudon, *Arb. Brit.* iii. 1446, f. 1269, t. — Hooker, *Fl. Bor.-Am.* ii. 143. — Torrey, *Fl. N. Y.* 181. — Darlington, *Fl. Cestr.* ed. 3, 263. — Ed. Morren, *Belge Hort.* vi. 223, t. 45, f. 8. — Curtis, *Rep. Geolog. Surv. N. Car.* 1860, iii. 43. — Chapman, *Fl.* 418. — C. de Candolle, *Ann. Sci. Nat.* sér. 4, xviii. 36, t. 2, f. 13, 14, 18; *Prodr.* xvi. pt. ii. 142. — Emerson, *Trees Mass.* 191, t. 12. — Sargent, *Forest Trees N. Am.* 10*th Census U. S.* ix. 132. — Watson & Coulter, *Gray's Man.* ed. 6, 468 — Mayr, *Wald. Nordam.* 158, f. 4, t. 4.

Hicorius ovatus, Sargent, *Garden and Forest*, ii. 460 (1889).

A tree, often seventy to ninety feet and occasionally one hundred and twenty feet in height, with a tall straight columnar shaft three or four feet in diameter, in the forest often free of branches for fifty or sixty feet above the ground, and then dividing into two or three comparatively small limbs which form a narrow head; or, when it has had sufficient space for its free development, sometimes dividing near the ground into stout slightly spreading limbs which form a narrow inversely conical round-topped head of more or less pendulous branches, or growing with a single stem, forked perhaps at half the height of the tree, and retaining its short small lateral branches which spread at nearly right angles to the trunk, droop toward their extremities, and form an oblong round-topped symmetrical head. The bark of the trunk is light gray, and from three quarters of an inch to an inch in thickness, and separates in thick strips often a foot or more long and six or eight inches wide, which remain more or less closely attached to the trunk by the middle, giving it the shaggy appearance to which the tree owes its common name; the bark of the young stems and branches is smooth and light gray. The branchlets are stout, and marked with oblong pale lenticels; when they first appear they are slightly angled, covered, like the young leaves and the inflorescence, with caducous brown scurf, and coated with pale grandular pubescence, and during their first year are bright reddish brown or light gray, glabrous and lustrous, or covered more or less thickly with short rufous pubescence, growing dark gray in their second year, and ultimately light gray. The leaf-scars are ovate to nearly semiorbicular in outline, or are very obscurely three-lobed, emarginate at the apex, pale, and slightly elevated. The terminal buds are broadly ovate, rather obtuse, and from one half to three quarters of an inch long, and from one third to one half of an inch broad; their three or four outer scales are broadly ovate, nearly triangular, acute, dark brown, pubescent and hirsute on the outer surface, the exterior ones being often abruptly narrowed into long rigid points, and, opening as the bud enlarges in the autumn, fall

before the appearance of the leaves in the spring: within these seven or eight scales protect the bud; the lowest and outermost of these are coated on their exterior surface with thick pale tomentum, and are lustrous and puberulous on the inner surface; the upper and inner side is puberulous, lustrous, covered with resinous glands, yellow-green, often tinged with red, especially above the middle, oblong-obovate, pointed at the apex, reflexed, and from two and one half to three inches long and half an inch broad at maturity, and usually persistent until after the aments of male flowers have fallen. The axillary buds appear with the leaves, and are coated at first with thick white tomentum, and when fully grown are from one third to one half of an inch in length. The leaves are composed of five or rarely of seven leaflets and of stout green glabrous or pubescent petioles slightly grooved and abruptly enlarged at the base, and are from eight to fourteen inches in length; the leaflets are ovate to ovate-lanceolate, or those at the end of the leaf are sometimes obovate, equilateral, and acuminate or rarely rounded at the apex and sessile or short-petiolulate; they are more or less thickly ciliate on the margins with soft white hairs, and serrate with minute incurved callous teeth except toward the base, which is equally or sometimes unequally wedge-shaped or occasionally rounded on both edges; when they unfold they are thin, light yellow-green and lustrous above, and coated below with pale pubescence, which is thickest along the under side of the midribs and on the petioles, and at maturity they are thin and firm, dark yellow-green and glabrous on the upper surface, and paler and glabrous and lustrous or puberulous on the lower surface. The terminal leaflet, which is decurrent at the base on a slender stalk from half an inch to an inch in length, is from five to seven inches long, from two to three inches broad, rather larger than the upper leaflets, and twice or often three times as large as those of the lowest pair. The catkins of staminate flowers are slender, light green, glandular-hirsute, and four or five inches long, with peduncles often an inch in length, and elongated linear-lanceolate scarious caducous lateral bracts; the flowers open late in the spring after the leaves have grown nearly to their full size; they are glandular-hirsute on the outer surface, and pedicellate with short slender pedicels about one eighth of an inch in length; the bract is elongated, acute, ovate-lanceolate, or often narrowed and wedge-shaped from near the middle to the base, and two or three times as long as the ovate concave lobes of the calyx, which are rounded or acute at the apex; there are four stamens with nearly sessile yellow anthers, tinged with red, and slightly hirsute above the middle, the lobes slightly spreading at the apex. The pistillate flowers, which are usually borne in two to five-flowered spikes, are one third of an inch long, and clothed with rusty tomentum; the bract is linear-lanceolate, elongated, much longer than the broader acute bractlets, and like them green above, and covered on both surfaces with pale scurfy pubescence and long scattered white hairs; the stigmatic lobes are pale green, and do not mature until most of the anthers have shed their pollen. The fruit, which is usually solitary or in pairs, is subglobose, rather longer than it is broad, or slightly obovate, depressed at the apex, from which the blackened remnants of the stigmas protrude, dark reddish brown or nearly black at maturity, roughened with small pale lenticels, glabrous or pilose, and from an inch to two and a half inches long; the husk, which splits freely nearly to the base, varies from one eighth to one half of an inch in thickness, and is hard and woody and pale on the inner surface. The nut is oblong, nearly twice as long as it is broad, or obovate and broader than it is long, compressed, prominently or obscurely four-ridged and angled, and sometimes furnished with two additional narrower ridges at the two sutures, more or less compressed, acute and gradually or abruptly narrowed or rounded or nearly truncate at the apex, which is tipped with a stout point equaling in length the valves of the fruit, gradually narrowed and rounded at the base, which is furnished with a dark bony point, longitudinally and irregularly rugose between the ridges, nearly white, reticulate-veined, and thick or rarely thin-walled, from half an inch to nearly two inches in length, and from three quarters of an inch to an inch in breadth, the walls and thin partitions being penetrated by small lacunæ.[1] The seed is two-lobed from

[1] Hales' paper-shell Hickory nut is the best known of those nuts of this species which are distinguished for thinness of shell and good quality. The tree that produces it is growing on bottom-lands near the Saddle River, on the farm of Mr. Henry Hales, a

the base nearly to the apex, with a short thin connective and flat cotyledons, which are narrowed and rounded at the base, divided nearly to the middle by the thin ventral partition, rounded and deeply lobed at the apex, irregularly and often prominently ridged on the back, and flat and rugose on the inner face; it is covered with a thin light brown rather lustrous coat, and is sweet, with an aromatic flavor.

Hicoria ovata ranges from southern Maine to the valley of the St. Lawrence River, where it finds its most northeasterly home in the neighborhood of Montreal,[1] thence southwestward along the northern shores of Lake Erie and Lake Ontario, through southern Michigan to central Minnesota[2] and southeastern Nebraska,[3] southward through the northern states, with the exception of the elevated regions of northern New England and northern New York, to Pennsylvania and Delaware, and along the Appalachian Mountains to western Florida, northern Alabama and Mississippi, and westward to central Kansas,[4] the Indian Territory, and eastern Texas.[5] It is usually found growing on low hills or in the neighborhood of streams and swamps in rich deep and moderately moist soil. Rare and comparatively local in the Province of Quebec, the Shellbark Hickory is abundant in the forests of southern Ontario, where it often grows to a large size. It abounds in southern New England and the central states; although it does not extend to the south Atlantic and Gulf coasts or ascend to high elevations on the southern mountains; it is not rare in the country lying at the eastern base of the Alleghany Mountains, but is most common on their western slopes and in the region watered by the tributaries of the lower Ohio River, where it grows to its largest size,[6] and in Missouri and Arkansas; in Kansas, the Indian Territory, and eastern Texas, it is comparatively rare and confined to the immediate neighborhood of streams.

The wood of *Hicoria ovata* is heavy, very hard and strong, tough, close-grained, and flexible; it contains numerous thin medullary rays and bands of from one to three rows of large open ducts clearly marking the layers of annual growth. It is light brown, with thin nearly white sapwood. The specific gravity of the absolutely dry wood is 0.8372, a cubic foot weighing 52.17 pounds. It is largely used in the manufacture of agricultural implements, in carriage and wagon-making, for axe-handles and baskets, and for fuel. The nuts are the common Hickory nuts of commerce, and are gathered in the forest in great quantities.

Hicoria ovata, according to Loudon,[7] was cultivated in England as early as 1629; and what is probably a description of this tree was published by Plukenet in his *Almagestum Botanicum* in 1696.[8]

The strong vigorous appearance of the Shellbark, the remarkable character of its bark hanging from the trunk in loose plates, the beauty of its head with its graceful winter outlines, the charm of its bursting buds with their bright petal-like scales, and its clean fragrant foliage, make it one of the most interesting and beautiful as well as one of the most valuable trees of the northern forest.[9]

few miles east of Ridgewood, Bergen County, New Jersey; the nut is about an inch and a half in length, and somewhat more in breadth, very wide and full at both ends, obscurely six-angled, and full, rounded, and deeply grooved on the back of the valves. The walls are not more than a thirty-second of an inch in thickness, and the partitions are proportionately thin. The flavor of the kernel, which keeps sweet for a remarkably long time, is unusually good. (See Fuller, *Practical Forestry*, 120, f. 31, 32. Fig. 6, plate cccxlvii. of this *Silva* represents this nut.)

[1] Brunet, *Cat. Vég. Lig. Can.* 47. — Bell, *Geolog. Rep. Can.* 1879–80, 55°. — Macoun, *Cat. Can. Pl.* 433.

[2] Macmillan, *Metaspermæ of the Minnesota Valley*, 178.

[3] Bessey, *Rep. Nebraska State Board Agric.* 1894, 109.

[4] Hitchcock, *The Woody Plants of Manhattan in Their Winter Condition*, 18.

[5] Coulter, *Contrib. U. S. Nat. Herb.* ii. 417 (*Man. Pl. W. Texas*).

[6] Ridgway, *Proc. U. S. Nat. Mus.* 1882, 77.

[7] *Arb. Brit.* iii. 1446, f. 1269, t.

[8] *Nux Juglans Virginiana alba minor, fructu Nucis moschatæ simili, cortice glabro, summo fastigio veluti in aculeum producto*, 264; *Phyt.* 309, f. 2.

Nux Juglans Virginiana alba, fructu parvo anguloso, cortice lævi, 264; *Phyt.* 309, f. 2 c.

These figures are not very good, however, and might almost as well represent some forms of the nuts of *Hicoria glabra* as those of this species.

[9] The demand for Hickory wood in the arts and for fuel is very great, and large individuals of this species, which is usually considered the best timber-tree of the genus, are no longer common in any part of the country. Few trees of the northern forest grow more slowly. The log specimen in the Jesup Collection of North American Woods in the American Museum of Natural History, New York, obtained from Missouri, is thirteen inches in diameter inside the bark, and shows two hundred and thirty-three layers of annual growth, forty-five of which are sapwood; but it probably indicates an exceptionally slow rate of growth, as the narrowness of the rings formed during the first one hundred and nine years shows that the tree was overshadowed at first by other trees, and its development stunted.

EXPLANATION OF THE PLATES.

Plate CCCXLVI. Hicoria ovata.

1. A flowering branch, natural size.
2. A staminate flower, rear view, enlarged.
3. A staminate flower, front view, enlarged.
4. A stamen, enlarged.
5. A pistillate flower, lateral view, enlarged.
6. Vertical section of a pistillate flower, enlarged.
7. A winter-bud, natural size.
8. Diagram of a winter-bud.

Plate CCCXLVII. Hicoria ovata.

1. A fruiting branch, natural size.
2. A valve of the fruit, natural size.
3. A nut, natural size.
4. Cross section of a nut cut through the middle, natural size.
5. An inversed cotyledon, natural size.
6. A thin-shelled nut, cut transversely, natural size.
7. A nut, natural size.

8

1

7

4

2

3

5

6

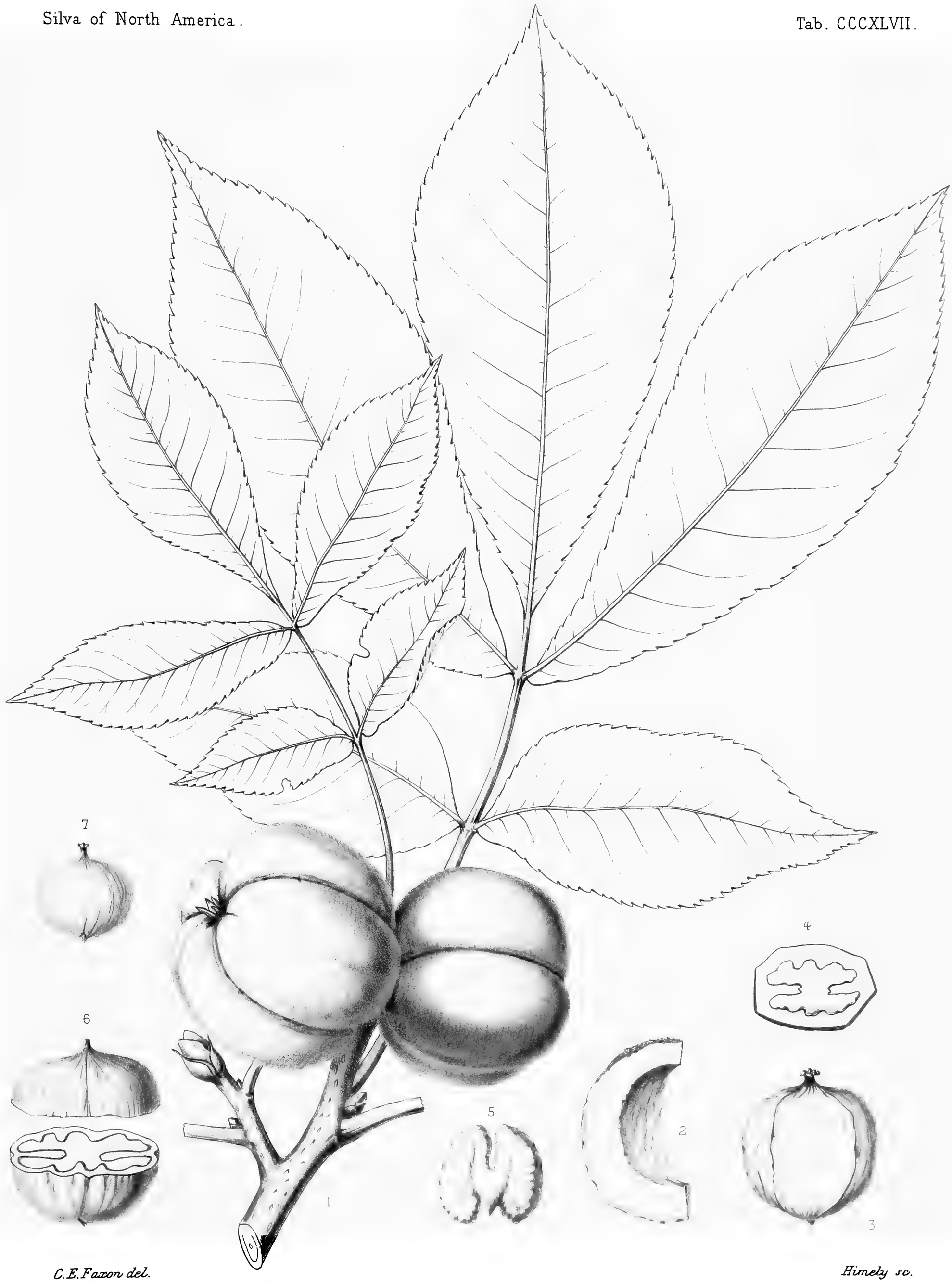
C.E. Faxon del.

Rapine sc.

HICORIA OVATA , Britt.

A. Riocreux direx.t

Imp. J. Taneur, Paris.



C.E. Faxon del.

Himely sc.

HICORIA OVATA, Britt.

A. Riocreux direx.t

Imp. J. Taneur, Paris

HICORIA LACINIOSA.

Big Shellbark. Bottom Shellbark.

LEAFLETS 5 to 9, obovate or oblong-lanceolate, puberulous on the lower surface. Fruit oblong, depressed at the apex; nut thick-walled, ridged or angled, dull white.

Hicoria laciniosa.

Juglans laciniosa, Michaux f. *Hist. Arb. Am.* i. 199, t. 8 (1810). — Poiret, *Lam. Dict.* Suppl. iv. 112. — W. P. C. Barton, *Compend. Fl. Phila.* ii. 178. — Audubon, *Birds*, t. 101.

Juglans sulcata, Pursh, *Fl. Am. Sept.* ii. 637 (not Willdenow) (1814).

Carya sulcata, Nuttall, *Gen.* ii. 221 (1818). — Elliott, *Sk.* ii. 624. — Sprengel, *Syst.* iii. 849. — Spach, *Hist. Vég.* ii. 174. — Loudon, *Arb. Brit.* iii. 1448, f. 1271. — Curtis, *Rep. Geolog. Surv. N. Car.* 1860, iii. 43. — Chapman, *Fl.* 418. — C. de Candolle, *Ann. Sci. Nat.* sér. 4, xviii. 36, t. 5, f. 51, 52; *Prodr.* xvi. pt. ii. 143. — Ridgway, *Proc. U. S. Nat. Mus.* 1882, 78. — Lauche, *Deutsche Dendr.* 308. — Sargent, *Forest Trees N. Am.* 10*th Census U. S.* ix. 133. — Watson & Coulter, *Gray's Man.* ed. 6, 468.

Carya pubescens, Sweet, *Hort. Brit.* 97 (1827).

Carya cordiformis, Koch, *Dendr.* i. 597 (1869).

Hicoria sulcata, Britton, *Bull. Torrey Bot. Club*, xv. 283 (1888).

Hicorius sulcatus, Sargent, *Garden and Forest*, ii. 460 (1889).

Hicoria acuminata, Dippel, *Handb. Laubholzk.* ii. 336 (1892). — Koehne, *Deutsche Dendr.* 72 D. D′.

A tree, occasionally one hundred and twenty feet in height, with a straight slender trunk often free of branches for more than half its height and rarely exceeding three feet in diameter, and comparatively small spreading branches which form a narrow oblong head. The bark of the trunk is from one to two inches thick and light gray, and separates into broad thick plates, which are frequently three or four feet long and sometimes remain for years hanging on the trunk; the bark of young stems and of the small branches is smooth and light or dark gray. The branchlets are stout, and when they first appear are slightly angled, dark or light orange-red, and pilose or covered with pale or rufous pubescence or tomentum; they soon become light orange-color and roughened by scattered elevated oblong pale lenticels, and during their first winter are orange-brown, glabrous or puberulous, and marked with oblong three-lobed emarginate leaf-scars; in their second year they turn ashy gray. The terminal buds are ovate, rather obtuse, sometimes an inch long and two thirds of an inch broad, and three or four times as large as the axillary buds; they are usually covered by eleven or twelve scales, the outer ones being dark brown, puberulous on the exterior surface, generally keeled, and long-pointed at the apex; the scales next within these are ovate, rounded, and coated with thick orange-colored tomentum, and, lengthening slightly in the spring, fall as the branch begins to grow; the six or seven inner scales are accrescent and become reflexed, the edges curling backward, and when fully grown are obovate, pointed and rounded at the apex, light green tinged with red or bright red or yellow and glabrous and lustrous on the inner face, and covered with silky pubescence on the outer, slightly resinous, two to three inches long and an inch broad, and fall with or before the catkins of staminate flowers. The leaves are fifteen to twenty-two inches in length, and are composed of from five to nine but usually of seven leaflets, and of stout glabrous or pubescent petioles flattened and grooved and then abruptly enlarged at the base, and very often persistent on the branches during the winter; the leaflets are usually placed at some distance apart on the petiole and are ovate or oblong-lanceolate, or broadly obovate, especially the upper ones, which are generally two or three times as long as those of the lowest pair, and are usually equilateral, acuminate with long slender points, equally or unequally wedge-shaped or rounded at the base, which is often oblique, finely serrate with incurved callous-tipped teeth, and sessile or sometimes raised on short stout stalks; when they unfold they are lustrous and red on the

upper surface as well as on the petioles, coated on the lower surface with soft pale pubescence, and ciliate on the margins with long white caducous hairs; and at maturity they are dark green and rather lustrous above, and pale yellow-green or bronzy brown and covered with soft pubescence below, especially along the broad yellow midribs and the numerous straight stout veins connected by prominent reticulate veinlets; the terminal leaflet, which is from five to nine inches long, three to five inches broad, and gradually narrowed at the base into a stout stalk often an inch in length, is not much larger than the upper lateral leaflets. The catkins of staminate flowers, which open from the middle of May in Missouri to the middle of June in central New York, are nearly glabrous or covered with rufous scurfy tomentum and from five to eight inches long, with common peduncles an inch to an inch and a quarter in length and lanceolate linear scarious dark brown caducous lateral bracts from half an inch to nearly an inch long; the flowers are short-pedicellate with linear-lanceolate acute bracts twice or thrice as long as the broader rounded lobes of the perianth, and, like them, coated on the outer surface with loose pale or rufous tomentum, and have hirsute yellow subsessile anthers more or less deeply emarginate at the apex. The pistillate flowers are usually produced in two to five-flowered spikes and are oblong-ovate, about twice as long as they are broad, slightly angled, and clothed with pale tomentum, with linear acute bracts much longer than the nearly triangular bractlets and calyx-lobes; the stigmas are light green and begin to wither before the anthers shed their pollen. The fruit, which is solitary or in pairs, is ellipsoidal, ovate or subglobose, depressed at the apex, roughened with minute orange-colored lenticels, downy with pale pubescence, or glabrate, light orange-colored or dark chestnut-brown at maturity, from an inch and three quarters to two and a half inches long and from an inch and a quarter to two inches broad, with a hard woody husk, pale and marked on the inside with dark conspicuous veins, and from a quarter to a third of an inch in thickness. The nut is ellipsoidal or slightly obovate, longer than it is broad, or sometimes as broad or broader than it is long, flat and rounded at both ends or gradually narrowed and rounded at the base, sometimes acuminate at the apex, more or less compressed, rather prominently four-ridged and angled or often six-ridged, full and rounded on the back of the two valves, furnished at the base with a stout long point, slightly reticulate-rugose, light yellow to reddish brown, and from an inch and a quarter to two inches and a quarter in length and from an inch and a half to an inch and three quarters in breadth, with a hard and bony shell from one eighth to one quarter of an inch in thickness. The seed, which is covered by a lustrous light chestnut-brown coat and is very sweet with an agreeable flavor, is divided nearly to the apex by the dorsal partition of the cavity of the nut; the cotyledons are flat, longitudinally and deeply two or three-grooved on the back by the broad inward projections of the wall of the nut, narrowed and rounded at the base, which is separated nearly to the middle by the thin ventral partition, and rounded and deeply two-lobed at the apex, the lobes being rather longer than the short thin connective.[1]

Hicoria laciniosa is distributed from the neighborhood of Muscatine on the banks of the Mississippi River in Iowa,[2] through Missouri and Arkansas, eastern Kansas[3] and the eastern portion of the Indian Territory,[4] and through southern Illinois and Indiana to central Tennessee,[5] western[6] and

[1] The Nussbaumer nut (*Silva*, t. cccxlix. f. 4), named for its discoverer, J. J. Nussbaumer of Okawville, Illinois, has been sometimes considered the fruit of a hybrid between *Hicoria laciniosa* and *Hicoria Pecan*. It is a light red-brown long-pointed nut with the ridges of the nut of *Hicoria laciniosa*, firm hard walls varying from one thirty-second to one eighth of an inch in thickness, thin partitions, and the large lacunæ peculiar to nuts of the species of Apocarya, but not found in the true Hickories (Fuller, *American Agriculturist*, xliii. 546, f.). A young tree raised from one of these nuts, and growing in Mr. A. S. Fuller's garden near Ridgewood, New Jersey, cannot be distinguished from plants of *Hicoria laciniosa* of the same age.

The Floyd nut, from a tree supposed to have grown in Indiana and propagated by Mr. R. M. Floyd of Cedar Rapids, Iowa, has the internal structure of the Nussbaumer nut, but is longer, fuller at the apex, and less prominently ridged; and is perhaps a hybrid. (See Fuller, *N. Y. Tribune*, weekly ed. July 9, 1892.)

[2] *Science*, xix. 23.

[3] Mason, *Variety and Distribution of Kansas Trees*, 12.

[4] In August, 1880, it was discovered near Ouachita, Indian Territory, by Mr. G. W. Letterman.

[5] Gattinger, *The Medical Plants of Tennessee*, 81.

[6] *Hicoria laciniosa* is not rare in the valley of the Genesee River, and the nuts, which are called king nuts, are sold in the markets of Geneseo.

central[1] New York, and eastern Pennsylvania.[2] It is an inhabitant of rich deep bottom-lands usually inundated during several weeks of every year; rare and local east of the Alleghany Mountains and comparatively rare in Arkansas, Kansas, and the Indian Territory, it is one of the commonest trees in the great river-swamps of central Missouri and the lower Ohio basin, where, growing with the Swamp White Oaks, the Tupelo, the Red Maple, the Spanish Oak, the Sweet Gum, the Red Ash, and the Swamp Cottonwood, it attains its greatest size and beauty.[3]

The wood of *Hicoria laciniosa* is heavy and very hard, strong and tough, close-grained and very flexible, with many obscure medullary rays and bands of one or two large open ducts marking the layers of annual growth. It is dark brown, with comparatively thin and nearly white sapwood. The specific gravity of the absolutely dry wood is 0.8108, a cubic foot weighing 50.53 pounds. Confounded commercially with the wood of *Carya ovata*, it is used in the manufacture of wagons and agricultural implements, for the handles of axes and other tools. The nuts are sold in the markets of some of the western states in large quantities, but commercially are not often distinguished from those of the Shellbark Hickory.

Hicoria laciniosa, which may be readily recognized at all seasons of the year by the orange-color of the young branchlets, is hardy as far north as eastern Massachusetts, and in cultivation grows rather more rapidly than the other true Hickories.[4] Introduced into England in 1804,[5] it is occasionally seen in the gardens of central and western Europe.[6]

[1] Dudley, *Bull. Cornell University*, ii. 84 (*Cayuga Flora*).

[2] *Hicoria laciniosa* has been seen by Professor Thomas C. Porter of Lafayette College in Franklin, Lancaster, and Bucks counties, and on the banks of the Juniata River in Huntingdon County, Pennsylvania.

[3] Ridgway, *Proc. U. S. Nat. Mus.* 1882, 78.

[4] Like the other Hickories, this is a slow-growing tree in the forest. The log specimen from Missouri in the Jesup Collection of North American Woods in the American Museum of Natural History, New York, is thirty-two inches in diameter inside the bark, and shows three hundred and forty layers of annual growth, forty-four of which are sapwood.

[5] Loudon, *Arb. Brit.* iii. 1448, f. 1271 (*Carya sulcata*).

[6] Like many other deciduous-leaved trees of eastern North America, the Hickories all grow badly in Europe; and I have never seen a large or well-grown specimen of any of the species there, although a century ago great numbers of nuts, carried over by the Michauxs, were planted in France, and many attempts to cultivate them have been made in Germany and England.

EXPLANATION OF THE PLATES.

Plate CCCXLVIII. Hicoria laciniosa.

1. A flowering branch, natural size.
2. A staminate flower, rear view, enlarged.
3. A staminate flower, front view, enlarged.
4. An anther, enlarged.
5. A pistillate flower, lateral view, natural size.
6. A winter branch, natural size.

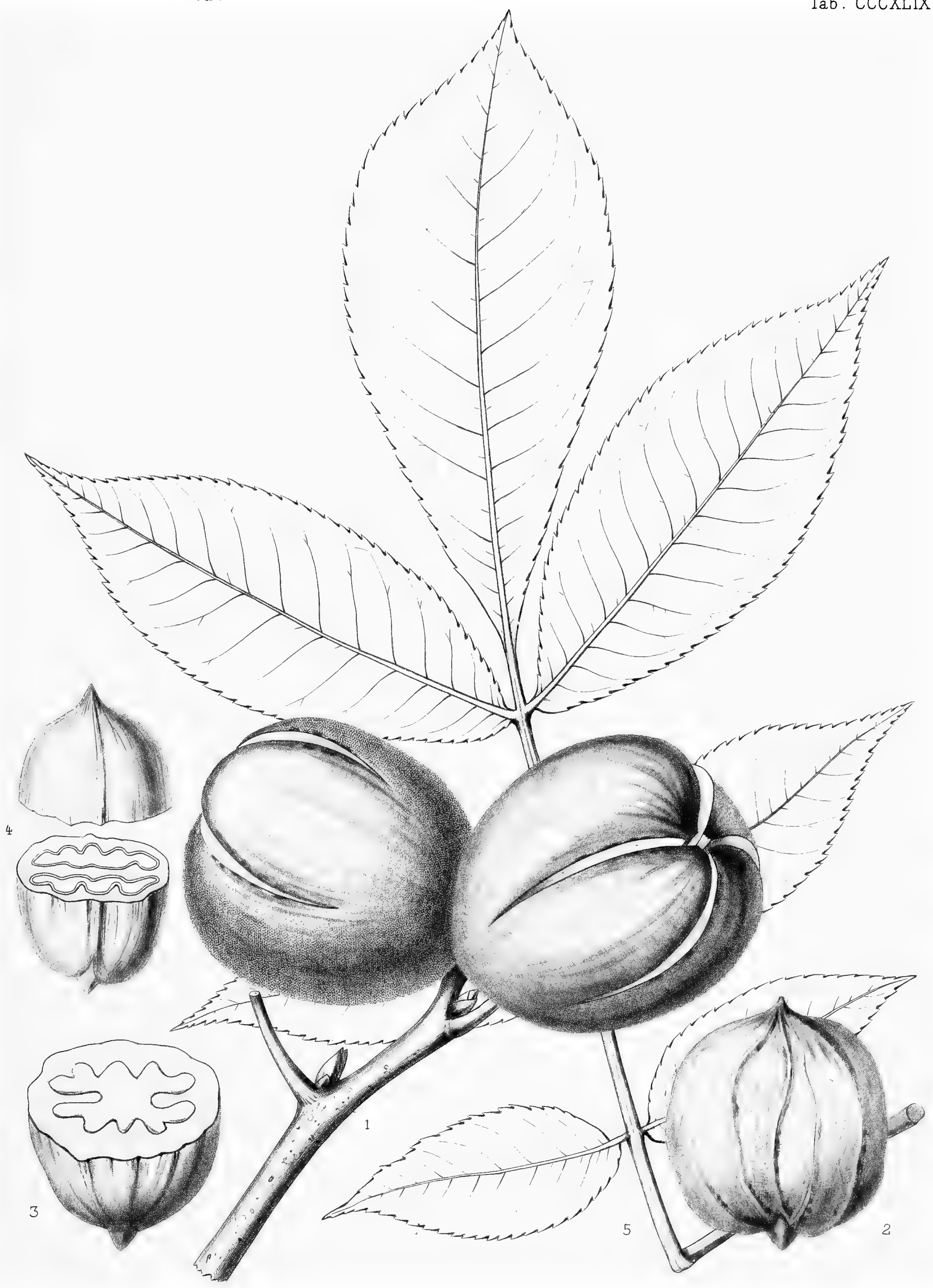
Plate CCCXLIX. Hicoria laciniosa.

1. A fruiting branch, natural size.
2. A nut, natural size.
3. Cross section of a nut, natural size.
4. A nut cut transversely, natural size.
5. A leaf, reduced.

C. E. Faxon del. Rapine sc.

HICORIA LACINIOSA, Sarg.

A. Riocreux direx.t Imp. J. Taneur, Paris.



C.E. Faxon del. *Himely sc.*

HICORIA LACINIOSA, Sarg.

A. Riocreux direx.t *Imp. J. Taneur, Paris.*

HICORIA ALBA.

Mockernut. Big Bud Hickory.

LEAFLETS 7 to 9, oblong-lanceolate or obovate-lanceolate, tomentose on the lower surface. Fruit subglobose to oblong; nut globose or oblong, often long-pointed, 4-ridged toward the apex, thick-shelled, reddish brown.

Hicoria alba, Britton, *Bull. Torrey Bot. Club*, xv. 283 (1888). — Dippel, *Handb. Laubholzk.* ii. 334. — Koehne, *Deutsche Dendr.* 72, f. 23 E. E'. — Coulter, *Contrib. U. S. Nat. Herb.* ii. 411 (*Man. Pl. W. Texas*).

Juglans alba, Linnæus, *Spec.* 997 (in part) (1753). — Du Roi, *Harbk. Baumz.* i. 333. — Kalm, *Acad. Stockh. Handl.* xxx. 119. — Muenchhausen, *Hausv.* v. 181. — Wangenheim, *Beschreib. Nordam. Holz.* 64; *Nordam. Holz.* 23, t. 10, f. 22. — Walter, *Fl. Car.* 235. — Aiton, *Hort. Kew.* iii. 360. — Gærtner, *Fruct.* ii. 50, t. 89, f. 1. — Moench, *Meth.* 696. — Abbot, *Insects of Georgia*, i. t. 29. — Willdenow, *Berl. Baumz.* 154; *Spec.* iv. 457. — Poiret, *Lam. Dict.* iv. 503; *Ill.* iii. 364, t. 781, f. 2. — Muehlenberg & Willdenow, *Neue Schrift. Gesell. nat. Fr. Berlin*, iii. 389. — Desfontaines, *Hist. Arb.* ii. 347. — Stokes, *Bot. Mat. Med.* iv. 400. — Bigelow, *Fl. Boston.* 228. — Watson, *Dendr. Brit.* ii. 148, t. 148.

Juglans rubra, Gærtner, *Fruct.* ii. 51, t. 89, f. 1 (1791). — Poiret, *Lam. Dict.* iii. 365, t. 781, f. 4.

Juglans tomentosa, Poiret, *Lam. Dict.* iv. 504 (1797). — Michaux, *Fl. Bor.-Am.* ii. 192. — Michaux f. *Hist. Arb. Am.* i. 184, t. 6. — Pursh, *Fl. Am. Sept.* ii. 637. — Du Mont de Courset, *Bot. Cult.* ed. 2, vi. 236.

? Juglans pubescens, Willdenow, *Berl. Baumz.* ed. 2, 196 (1811); *Enum.* Suppl. 64.

Carya tomentosa, Nuttall, *Gen.* ii. 221 (1818). — Elliott, *Sk.* ii. 625. — Sprengel, *Syst.* ii. 849. — Spach, *Hist. Vég.* ii. 176. — Loudon, *Arb. Brit.* iii. 1445, f. 1267. — Torrey, *Fl. N. Y.* ii. 182. — Darlington, *Fl. Cestr.* ed. 3, 263. — Curtis, *Rep. Geolog. Surv. N. Car.* 1860, iii. 43. — Chapman, *Fl.* 419. — C. de Candolle, *Ann. Sci. Nat.* sér. 4, xviii. 36; *Prodr.* xvi. pt. ii. 143. — Emerson, *Trees Mass.* 194, t. 13. — Sargent, *Forest Trees N. Am.* 10*th Census U. S.* ix. 133. — Watson & Coulter, *Gray's Man.* ed. 6, 468. — Mayr, *Wald. Nordam.* 160.

Carya tomentosa, var. **maxima**, Nuttall, *Gen.* ii. 221 (1818); *Sylva*, i. 40. — Loudon, *Arb. Brit.* iii. 1445. — C. de Candolle, *Prodr.* xvi. pt. ii. 143.

Hicoria maxima, Rafinesque, *Alsograph. Am.* 67 (1838).

Carya alba, Koch, *Dendr.* i. 596 (not Nuttall) (1867). — Lauche, *Deutsche Dendr.* 318.

Hicoria alba, var. **maxima**, Britton, *Bull. Torrey Bot. Club*, xv. 283 (1888).

Hicorius albus, Sargent, *Garden and Forest*, ii. 460 (1889).

A tree, rarely one hundred feet high, usually much smaller, with a tall trunk occasionally three feet in diameter and comparatively small spreading branches which make a narrow or often, when not crowded by other trees, a broad round-topped head of upright rigid or of graceful pendulous branches. The bark of the trunk is from one half to three quarters of an inch thick, slightly ridged by shallow irregular interrupted fissures and covered with light or dark gray closely appressed scales. The branchlets are stout and terete, and when they first appear are slightly angled and clothed, like the pedicels, the inner surface of the leaves and the flower-clusters, with thick pale tomentum, and during their first year are rather bright red-brown, nearly glabrous, pubescent or tomentose, marked with conspicuous pale lenticels, and in winter with pale emarginate leaf-scars which are sometimes almost equally lobed or are elongated, with the lower lobe two or three times as long as the others, and which display minute and mostly marginal clusters of pale fibro-vascular bundle-scars; in their second year the branches become light or dark gray. The terminal buds are broadly ovate, acute or obtuse, and from one half to three quarters of an inch in length, being two or three times as large as the axillary buds, which, when they appear on the young branchlets in early spring, are coated with long white hairs; the three or four outer bud-scales are ovate, acute, often keeled, or apiculate, thick and firm, dark reddish brown and pilose on the outer surface, and usually fall late in the autumn, disclosing the closely imbricated ovate rounded and short-pointed inner scales which are clothed externally with thick light yellow silky lustrous tomen-

tum, and cover the bud during the winter; they are slightly accrescent in the spring, and fall soon after the branch begins to grow; the innermost scales, which do not fall until after the opening of the staminate flowers, are at maturity ovate, rounded or acute and short-pointed at the apex, light green and covered with soft silky pubescence on the outer, and often bright red and pilose on the inner surface, from an inch to an inch and a half long and half an inch broad, becoming much reflexed and twisted before falling. The leaves, which are from eight to twelve inches in length, are more fragrant, with a powerful pleasant resinous odor, than those of other Hickory-trees, and are composed of five or seven leaflets and of hirsute or tomentose petioles flattened and grooved and gradually much enlarged at the base; the leaflets are oblong-lanceolate, or are obovate-lanceolate toward the extremity of the leaf, gradually or abruptly acuminate with long or short points, mostly equilateral, equally or unequally rounded or wedge-shaped at the base which is sometimes rounded on one side and oblique on the other, and minutely or sometimes coarsely and occasionally very obscurely serrate, and are sessile or short-petiolulate with the exception of the terminal one which is decurrent by its wedge-shaped base on a short stalk varying from one quarter to one half of an inch in length; when they unfold they are thin, light yellow-green, covered with soft pale pubescence, and tipped at the apex with clusters of long pale hairs, and at maturity are dark yellow-green and rather lustrous above, and lustrous, paler or often light orange-color or brown on the lower surface which is clothed with soft pale pubescence, most thickly along the stout yellow midribs, slightly impressed and often hirsute above, and along the slender veins connected by fine reticulate veinlets; the upper leaflets are from five to eight inches long, and from three to five inches wide, and are often two or three times as large as those of the lowest pair. The catkins of staminate flowers are four or five inches in length, with slender light green stems and common peduncles coated with matted hairs, and lanceolate acute scarious hairy caducous lateral bracts half an inch in length; the flowers, which open from the beginning of April in southern Florida to the end of May in eastern New England, are short-pedicellate, pale yellow-green, from one sixteenth to one eighth of an inch long, and scurfy-pubescent on the outer surface, with elongated ovate-lanceolate bracts ending in tufts of long pale hairs and three or four times the length of the ovate rounded calyx-lobes; there are four stamens with nearly sessile oblong emarginate bright red hirsute anthers. The pistillate flowers are produced in crowded two to five-flowered spikes and are slightly contracted above the middle and coated with pale tomentum; the anterior bract is ovate, acute, sometimes a quarter of an inch long, about twice the length of the broadly ovate nearly triangular bractlets and calyx-lobe, and, like them, glabrous or puberulous on the inner surface; the stigmas are dark red and begin to wither before the anthers shed their pollen. The fruit is ellipsoidal or obovate, gradually narrowed at both ends, acute at the apex, abruptly contracted toward the base, more or less roughened with small lenticels, pilose or nearly glabrous, dark reddish brown, and from an inch and one half to two inches long, with a husk about one eighth of an inch thick splitting to the middle or nearly to the base. The nut is nearly globose or ellipsoidal or obovoid-oblong, narrowed at both ends, rounded at the base, and acute and sometimes attenuated and long-pointed at the apex, much or only slightly compressed, obscurely or prominently four-ridged, rather conspicuously reticulate-venulose, light reddish brown, becoming darker and sometimes red with age, from three quarters of an inch to two inches in length and from three quarters of an inch to an inch and a quarter in width, with very thick hard walls and partitions, and a small sweet seed deeply divided by the partitions of the cavity and covered by a dark brown lustrous coat, the cotyledons being deeply grooved on the back by the broad longitudinal ridges on the inner face of the wall of the nut.

Hicoria alba is distributed from southern Ontario[1] southward to Cape Canaveral and the shores of Tampa Bay in Florida, and westward to Missouri, eastern Kansas[2] and the Indian Territory, and the valley of the Brazos River in Texas. Comparatively rare at the north, where it grows on ridges and hillsides in rich soil, or less frequently on the alluvial of river-bottoms, *Hicoria alba* is the commonest

[1] Brunet, *Cat. Vég. Lig. Can.* 47. — Macoun, *Cat. Can. Pl.* 433. [2] Mason, *Variety and Distribution of Kansas Trees*, 12.

and most generally distributed of the Hickory-trees in the south, and grows to its largest size in the basin of the lower Ohio River[1] and in Missouri and Arkansas. It is the only Hickory found in the Pine forests of the sandy maritime Pine-belt of the southern states, where it is not rare, and with the Pignut it grows in great abundance on low sandy hummocks close to the shores of bays and estuaries along the coast of the south Atlantic and Gulf states.

The wood of *Hicoria alba* is heavy, very hard, strong, tough, close-grained, and flexible, with many thin obscure medullary rays and numerous large regularly distributed open ducts. It is a rich dark brown, with thick nearly white sapwood. The specific gravity of the absolutely dry wood is 0.8218, a cubic foot weighing 51.21 pounds. Confounded commercially with the wood of the Shell-bark Hickories, it is used for the same purposes.

The abundance of this species[2] on the shores of Virginia and the other southern states probably made it known to Europeans earlier than any of the other Hickories, and it was first described by Parkinson in his *Theatrum Botanicum*,[3] published in 1640.

[1] Ridgway, *Proc. U. S. Nat. Mus.* 1882, 78.

[2] *Hicoria alba* is sometimes called Black Hickory, Bull Nut, and White Heart Hickory.

[3] *Nux Juglans Virginiana*, 1414. — Catesby, *Nat. Hist. Car.* i. 38, t. 38 (in part).

Nux Juglans alba Virginensis, Ray, *Hist. Pl.* ii. 1377, 1915.

Nux Juglans Virginiana foliis vulgaris similis, fructu subrotundo, cortice duriore lævi, Plukenet, *Alm. Bot.* 264. — Miller, *Dict.* No. 9. — Duhamel, *Traité des Arbres*, ii. 51.

Juglans alba, fructu ovato compresso, profunde insculpto durissimo: cavitate intus minima, plerumque apyrena, Clayton, *Fl. Virgin.* 190.

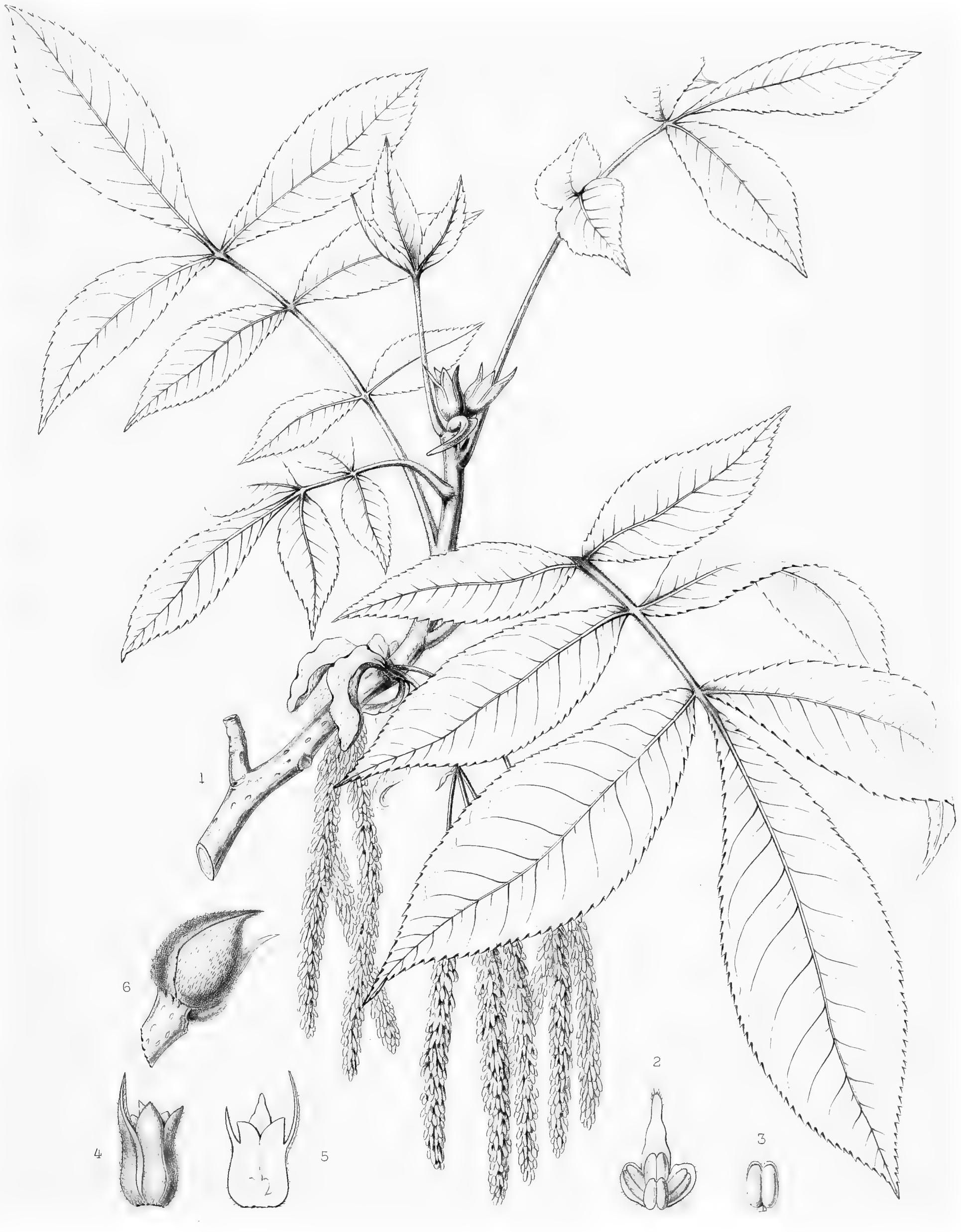
EXPLANATION OF THE PLATES.

Plate CCCL. Hicoria alba.

1. A flowering branch, natural size.
2. A staminate flower, front view, enlarged.
3. A stamen, enlarged.
4. A pistillate flower, lateral view, enlarged.
5. Vertical section of a pistillate flower, enlarged.
6. A winter-bud, natural size.

Plate CCCLI. Hicoria alba.

1. A fruiting branch, natural size.
2. An oblong fruit, natural size.
3. Cross section of a fruit, natural size.
4. A nut, natural size.
5. A nut, natural size.
6. A nut, natural size.
7. Vertical section of a nut, natural size.



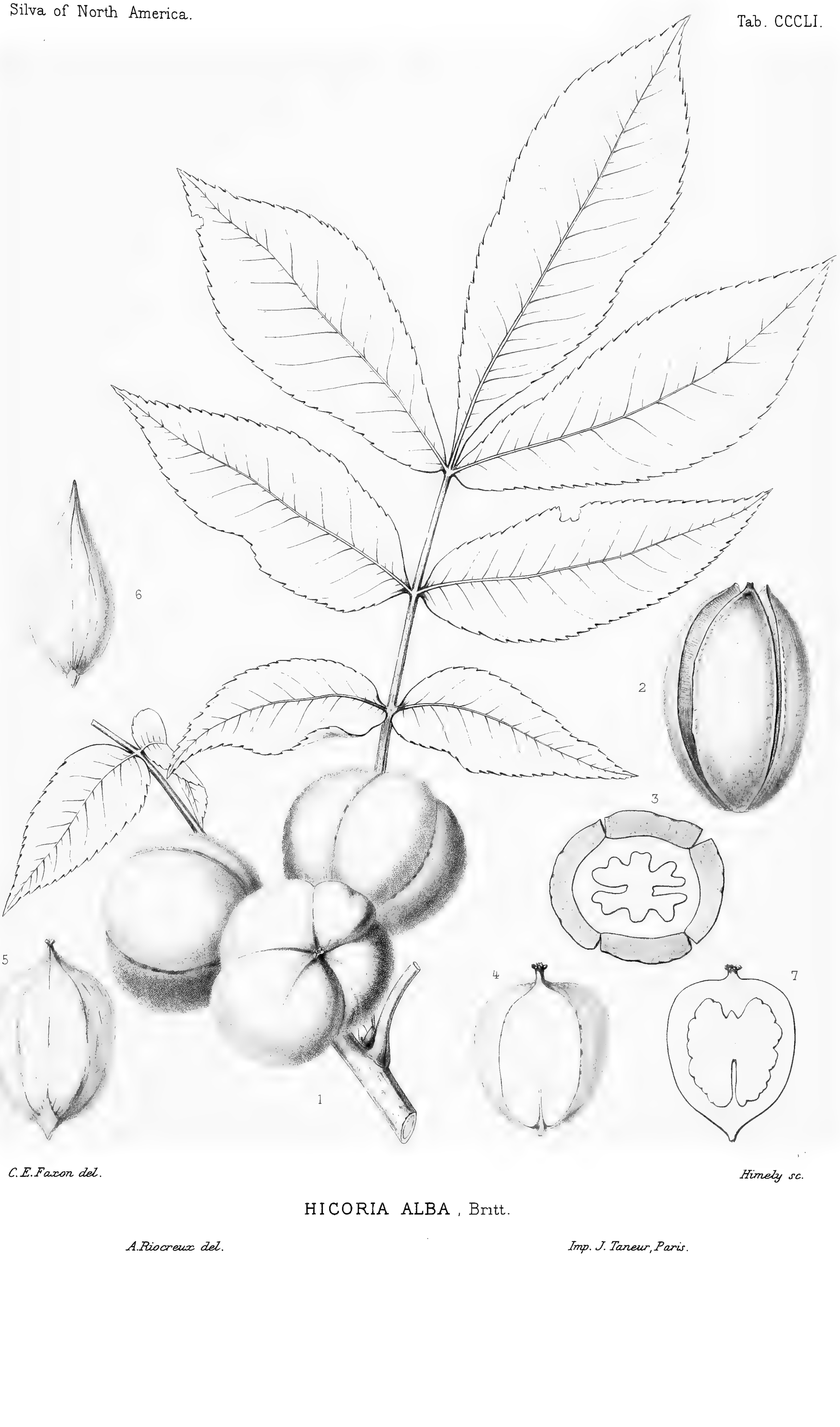
C.E. Faxon del.

Himely sc.

HICORIA ALBA, Britt.

A. Riocreux direx.t

Imp. J. Taneur, Paris.



C.E.Faxon del.

Himely sc.

HICORIA ALBA, Britt.

A.Riocreux del.

Imp. J. Taneur, Paris.

HICORIA GLABRA.

Pignut.

LEAFLETS 5 to 7, oblong or obovate-lanceolate, glabrous or villous-pubescent. Fruit pyriform or globose; husk usually thin; nut oblong, oval or globose, thick or thin-shelled; kernel sweet or slightly bitter.

Hicoria glabra, Britton, *Bull. Torrey Bot. Club*, xv. 284 (1888). — Dippel, *Handb. Laubholzk.* ii. 331. — Koehne, *Deutsche Dendr.* 70, f. 23, B. B′.

Juglans glabra, Miller, *Dict.* ed. 8, No. 5 (1768). — Muenchhausen, *Hausv.* v. 181. — Du Roi, *Harbk. Baumz.* i. 335. — Wangenheim, *Nordam. Holz.* 25, t. 10, f. 24. — Muehlenberg & Willdenow, *Neue Schrift. Gesell. nat. Fr. Berlin*, iii. 391. — Willdenow, *Spec.* iv. 458; *Berl. Baumz.* ed. 2, 196. — Persoon, *Syn.* ii. 566. — Bigelow, *Fl. Boston.* 229. — Hayne, *Dendr. Fl.* 164.

Juglans alba acuminata, Marshall, *Arbust. Am.* 68 (1785). — Castiglioni, *Viag. negli Stati Uniti*, ii. 262.

Juglans squamosa, Poiret, *Lam. Dict.* iv. 504 (1797). — Desfontaines, *Hist. Arb.* ii. 348.

Juglans obcordata, Muehlenberg & Willdenow, *Neue Schrift. Gesell. nat. Fr. Berlin*, iii. 392 (not Poiret) (1801). — Willdenow, *Spec.* iv. 458. — Persoon, *Syn.* 566.

Juglans porcina, Michaux f. *Hist. Arb. Am.* i. 206, t. 9 (1810). — Pursh, *Fl. Am. Sept.* ii. 638. — Audubon, *Birds*, t. 91.

Juglans porcina, α **obcordata**, Pursh, *Fl. Am. Sept.* ii. 638 (1814). — W. P. C. Barton, *Compend. Fl. Phila.* ii. 180. — Watson, *Dendr. Brit.* ii. 167, t. 167.

Juglans porcina, β **ficiformis**, Pursh, *Fl. Am. Sept.* ii. 638 (1814). — W. P. C. Barton, *Compend. Fl. Phila.* ii. 180.

Carya porcina, Nuttall, *Gen.* ii. 222 (1818). — Elliott, *Sk.* ii. 627. — Sprengel, *Syst.* iii. 849. — Spach, *Hist. Vég.* ii. 178. — Darlington, *Fl. Cestr.* ed. 2, 546. — Loudon, *Arb. Brit.* iii. 1449, f. 1272–1274. — C. de Candolle, *Ann. Sci. Nat.* sér. 4, xviii. 36, t. 1, f. 5, t. 5, f. 54; *Prodr.* xvi. pt. ii. 143. — Ridgway, *Proc. U. S. Nat. Mus.* 1882, 78. — Lauche, *Deutsche Dendr.* 306. — Sargent, *Forest Trees N. Am. 10th Census U. S.* ix. 134. — Watson & Coulter, *Gray's Man.* ed. 6, 469.

Carya obcordata, Sweet, *Hort. Brit.* 97 (1827).

Carya glabra, Spach, *Hist. Vég.* ii. 179 (1834). — Sweet, *Hort. Brit.* 97. — Nuttall, *Sylva*, i. 40. — Torrey, *Fl. N. Y.* ii. 182, t. 101. — Gray, *Man.* 412. — Darlington, *Fl. Cestr.* ed. 3, 264. — Curtis, *Rep. Geolog. Surv. N. Car.* 1860, iii. 44. — Chapman, *Fl.* 419. — Koch, *Dendr.* i. 594.

Carya amara, var. **porcina**, Darby, *Bot. S. States*, 513 (1855).

Hicorius glaber, Sargent, *Garden and Forest*, ii. 460 (1889).

A tree, eighty to ninety or occasionally one hundred and twenty feet in height, with a tall slender often forked trunk, occasionally from three to four feet in diameter, and spreading limbs which form a rather narrow head of slender more or less pendulous and often contorted branches. The bark of the trunk is from one half to three quarters of an inch thick, and light gray, with a firm close surface, usually divided by small fissures, the surface of the low ridges separating in close loose scales; or sometimes scaly, with loose thick plate-like scales five or six inches long. The branchlets are slender, and marked with oblong pale lenticels, and when they first appear are slightly angled, light green, nearly glabrous, often covered with yellow scurf, puberulous, tomentose, or coated with long pale hairs; during their first year they are rather light red-brown, glabrous, or rarely puberulous or pubescent, and turn dark red in their second season. The leaf-scars are comparatively small, semiorbicular to oblong, obscurely lobed, and slightly emarginate at the apex. The terminal buds are usually about a quarter of an inch or sometimes fully half an inch in length,[1] ellipsoidal, acute or obtuse, and two or three times as large as the axillary buds; the outer scales are acute or often slightly keeled, and frequently long-pointed at the apex, light orange-brown or dark reddish brown, lustrous, and covered with soft

[1] On the shores of Mobile Bay, where the Pignut grows at the water's edge on sandy dunes, and at Bluffton, South Carolina, the buds are fully twice as large as those of the common northern forms, and much larger than I have seen them in any other part of the country.

short pubescence, and sometimes with clusters of yellow articulate hairs, and, beginning to unfold early in the autumn, occasionally fall before winter, or early in the spring; the scales immediately within these are clothed on the outer surface with thick yellow lustrous silky pubescence, and are somewhat accrescent, strap-shaped, rounded or short-pointed at the apex, and often three quarters of an inch long when fully grown; the inner scales increase in size from without inward, and are yellow-green more or less tinged with red, covered with long pale hairs on the outer surface, lustrous on the inner, lanceolate and acute to broadly obovate and apiculate, frequently two and a half inches in length and an inch and a quarter in width, and reflexed and more or less curled before falling. The leaves are composed of five or seven, or rarely of nine, leaflets, and of slender glabrous or pubescent petioles, slightly grooved and enlarged at the base, and are from eight to twelve inches long; the leaflets are oblong to obovate-lanceolate, gradually or abruptly long-pointed at the apex, equally or unequally rounded at the base, sharply serrate with incurved teeth, subsessile or short-petiolulate, or the terminal one decurrent on a slender stalk, and from a quarter of an inch to nearly an inch in length; when they unfold they are bright bronzy green, covered below with long pale hairs, glandular-punctate with dark mostly deciduous glands, which usually disappear before midsummer, and furnished with tufts of long snowy white hairs at the base, pilose above along the midribs and primary veins, and ciliate on the margins with long pale or rufous hairs; and at maturity they are thick and firm, glabrous and dark yellow-green on the upper surface, and glabrous or rarely pubescent, and often furnished with tufts of pale hairs in the axils of the slender primary veins on the lower surface, which is much lighter colored and sometimes bright yellow or yellow-brown; the upper leaflets are from six to eight inches long, and two to two and a half inches broad, and are three or four times as large as those of the lowest pair. The catkins of staminate flowers are from three to seven inches long, with stout common peduncles from half an inch to an inch and a quarter in length, covered, like the slender rhachises, with soft pale scurfy pubescence, and linear-lanceolate scarious hirsute lateral bracts; the flowers, which open from the middle of March in Texas to the beginning of June in New England, are short-pedicellate, yellow-green, and coated with pale pubescence or tomentum; the bract, which is very variable in size and shape, is lanceolate, acute, and much longer than the ovate rounded calyx-lobes, or it is ovate, rounded, and does not much exceed them in length; there are four stamens, with nearly sessile ovate emarginate orange-colored anthers, slightly hirsute above the middle. The female flowers are produced in from two to five-flowered spikes, and are about one quarter of an inch long, more or less prominently four-ribbed, and nearly glabrous or coated with scurfy pubescence or with pale tomentum; the bract is lanceolate, acute, sometimes half an inch long, or usually shorter, much longer than the ovate acute bractlets and the calyx-lobe, and, like them, dark green and glabrous on the inner surface, and more or less covered with pale hairs on the outer surface and along the margins; the stigmatic lobes are yellow, and begin to wither before the anthers shed their pollen. The fruit, which is extremely variable in shape and size, is pyriform, ellipsoidal or subglobose, rounded or often much depressed at the apex, abruptly or gradually narrowed at the base, cylindrical or often obscurely winged to the middle or nearly to the base, rather bright reddish brown, often pubescent or covered with scattered clusters of bright yellow hairs, from an inch and a half to two inches long, and from three quarters of an inch to an inch and a half broad; the valves, which vary from one thirty-second to one sixteenth of an inch in thickness, open in some forms only at the apex, and continue to inclose the nut after it has fallen to the ground, and in others split to the middle or nearly to the base. The nut is ellipsoidal to subglobose, often nearly as broad as it is long, rounded at both ends, or obcordate or rarely acuminate at the apex, obscurely four-angled, compressed or sometimes nearly cylindrical, and from half an inch to an inch and a half in length, with thick or thin hard walls and partitions, and a small seed with cotyledons deeply divided at the base, and often deeply grooved on the back by the thick longitudinal ridges on the inner face of the wall, and a light brown coat.

Hicoria glabra inhabits dry ridges and hillsides, and is distributed from southern Maine to

southern Ontario,[1] and through southern Michigan to southeastern Nebraska,[2] and southward to the shores of the Indian River and Peace Creek in Florida and to southern Alabama and Mississippi, and through Missouri and Arkansas[3] to eastern Kansas[4] and the Indian Territory, and to the valley of the Nueces River in Texas. Extremely common in all the northern states, the Pignut ascends to higher elevations on the southern Appalachian Mountains than the other Hickories; it abounds on the shores of bays and estuaries along the coast of the south Atlantic and Gulf states, and ranges farther south in Florida than the other species, and, with the exception of the Pecan, farther to the southwest in Texas. In Missouri and Arkansas it is perhaps the commonest species, and it probably attains its largest size in the basin of the lower Ohio River.

The wood of *Hicoria glabra* is heavy, hard, very strong and tough, flexible and close-grained. It contains numerous thin obscure medullary rays and many large open ducts, and is light or dark brown, with thick lighter colored or often nearly white sapwood. The specific gravity of the absolutely dry wood is 0.8217, a cubic foot weighing 51.21 pounds. It is used for the handles of tools and in the manufacture of wagons and agricultural implements, and commercially is not distinguished from the wood of the Shellbark Hickories.

The earliest authentic account of *Hicoria glabra*, with an excellent figure of the nut, appeared in Catesby's *Natural History of Carolina*,[5] published in 1731; according to Aiton,[6] it was introduced into English gardens in 1799.

Less variable than several of the other Hickory-trees in habit, foliage, and flowers, *Hicoria glabra* varies more than any of them in the size and shape of its fruit; in one form the fruit is oblong and usually pyriform, with thick husks splitting nearly to the middle or to the base, and thick-shelled nuts; in another[7] it is subglobose, with rather thinner husks splitting freely to the base, and small comparatively thin-shelled nuts and better flavored kernels than those of the pear-shaped form. In Missouri a variety[8] of the Pignut[9] with remarkably small buds, branchlets, petioles, and leaflets clothed with soft villous pubescence, and rather large subglobose thick-shelled fruit, is common on dry flinty hills in the neighborhood of Allenton.

[1] Macoun, *Cat. Can. Pl.* 433.

[2] Bessey, *Rep. Nebraska State Board Agric.* 1894, 109.

[3] Harvey, *Am. Jour. Forestry*, i. 453.

[4] Mason, *Variety and Distribution of Kansas Trees*, 12.

[5] *Nux Juglans Carolinensis fructu minimo putamine lævi*, i. 38, t. 38.

? Juglans alba, fructu minori, cortice glabro, Clayton, *Fl. Virgin.* 118.

[6] *Hort. Kew.* ed. 2, v. 297 (*Juglans glabra*).

[7] *Hicoria glabra*, var. *odorata*.

Juglans alba odorata, Marshall, *Arbust. Am.* 68 (1785).

Carya microcarpa, Nuttall, *Gen.* ii. 221 (1818); Sprengel, *Syst.* iii. 849. — Loudon, *Arb. Brit.* iii. 1451. — Darlington, *Fl. Cestr.* ed. 3, 264. — Curtis, *Rep. Geolog. Surv. N. Car.* 1860, iii. 44. — Chapman, *Fl.* 419. — De Candolle, *Prodr.* xvi. pt. ii. 143. — Gray, *Man.* ed. 5, 448. — Koch, *Dendr.* i. 596. — Ridgway, *Proc. U. S. Nat. Mus.* 1882, 77. — Lauche, *Deutsche Dendr.* 308. — Dudley, *Bull. Cornell University*, ii. 83 (*Cayuga Flora*). — Watson & Coulter, *Gray's Man.* ed. 6, 469.

Juglans squamosa, β *microcarpa*, W. P. C. Barton, *Compend. Fl. Phila.* ii. 179 (1818).

Hicoria microcarpa, Britton, *Bull. Torrey Bot. Club*, xv. 283 (1888).

Hicorius odoratus, Sargent, *Garden and Forest*, ii. 460 (1889).

Hicoria odorata, Dippel, *Handb. Laubholzk.* ii. 335 (1892).

This form was recognized by Humphrey Marshall, who first described it. It was known to Muehlenberg, the younger Michaux, Bigelow, and Pursh, although only the first of these authors considered it specifically distinct from the Pignut with oblong fruit. Nuttall described a small-fruited Hickory in his *Genera of North American Plants*, but figured in his *Sylva* as *Carya microcarpa*, a small fruit of *Carya ovata* with a branch of what is possibly the Pignut, as shown by his specimen preserved in the herbarium of the Philadelphia Academy; and in his *Sylva* recognized the two forms of *Hicoria glabra*.

Hicoria glabra, var. *odorata*, is common in eastern Massachusetts, in Connecticut, eastern and central New York, eastern Pennsylvania, Delaware, the District of Columbia, central Michigan, southern Indiana and Illinois, and in Missouri. In Massachusetts and in some parts of New York it grows side by side with the other form, the two trees being indistinguishable, but in other states it is sometimes found in rather low ground, when the bark is scaly, although in rich soil trees with pear-shaped fruit sometimes have more scaly bark.

[8] *Hicoria glabra*, var. *villosa*.

[9] *Hicoria glabra* is sometimes called Brown Hickory, Black Hickory, and Broom Hickory. The last name is said to be due to the fact that in the early settlement of the country brooms were made with narrow strips split from the wood of this tree, and probably also from that of the other species. It has been suggested that its most common name, the Pignut, is a corruption of Fignut, from the shape of the fruit (Tucker, *Trees of Worcester*, 57), but Pignut, according to Catesby, was in use in Virginia early in the eighteenth century.

EXPLANATION OF THE PLATES.

Plate CCCLII. Hicoria glabra.

1. A flowering branch, natural size.
2. A staminate flower, front view, enlarged.
3. A staminate flower, rear view, enlarged.
4. A stamen, enlarged.
5. A pistillate flower, enlarged.
6. Vertical section of a pistillate flower, enlarged.
7. A winter branch, natural size.

Plate CCCLIII. Hicoria glabra.

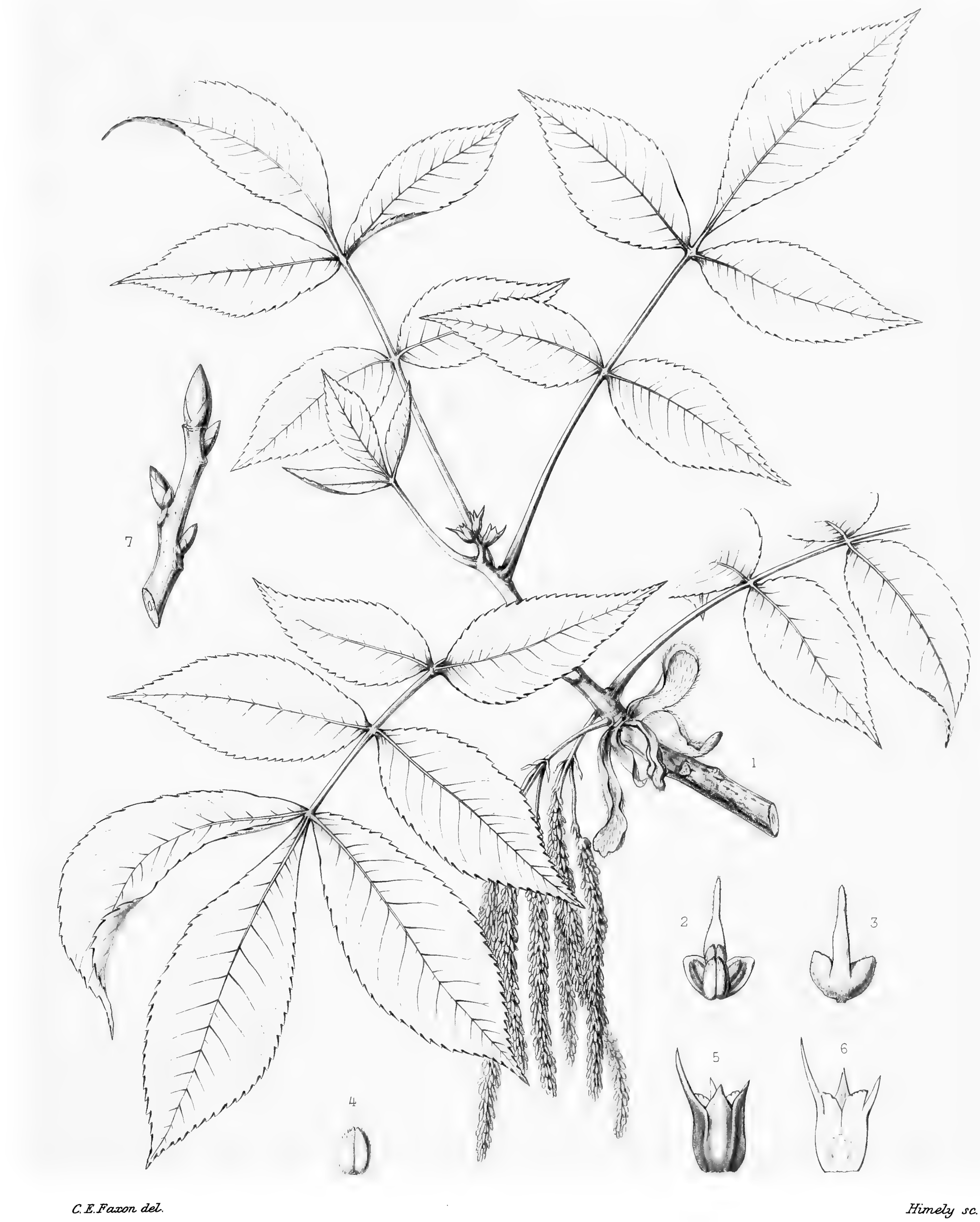
1. A fruiting branch, natural size.
2. A nut, natural size.
3. A nut, natural size.
4. Vertical section of a nut, natural size.
5. Cross section of a nut, natural size.

Plate CCCLIV. Hicoria glabra, var. odorata.

1. A flowering branch, natural size.
2. A staminate flower, rear view, enlarged.
3. A stamen, enlarged.
4. A pistillate flower, enlarged.
5. A fruiting branch, natural size.
6. A fruit, natural size.
7. A fruit, natural size.
8. A fruit, natural size.
9. A nut, natural size.
10. A nut, natural size.
11. A winter branchlet, natural size.

Plate CCCLV. Hicoria glabra, var. villosa.

1. A flowering branch, natural size.
2. A male flower, rear view, enlarged.
3. A male flower, front view, enlarged.
4. A fruiting branch, natural size.
5. A nut, natural size.
6. One of the valves of the fruit, natural size.
7. A winter branchlet, natural size.



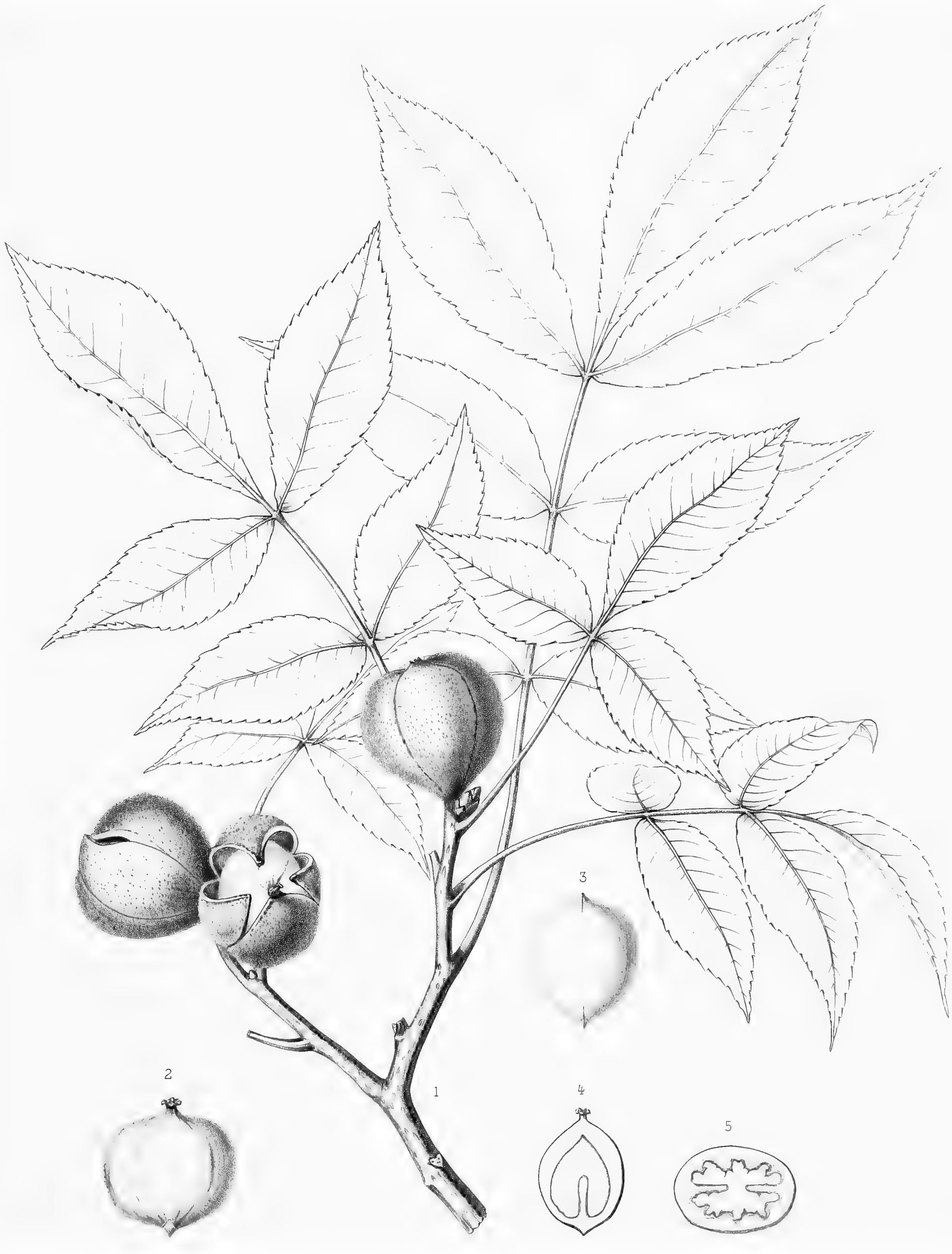
C.E.Faxon del.

Himely sc.

HICORIA GLABRA, Britt.

A.Riocreux direx.t

Imp. J.Taneur, Paris



C.E. Faxon del.

Himely sc.

HICORIA GLABRA, Britt.

A. Riocreux direx.t

Imp. J. Taneur, Paris.

C.E.Faxon del. *Himely sc.*

HICORIA GLABRA, Var. ODORATA, Sarg.

A.Riocreux direx.t. *Imp. J. Taneur, Paris*

C.E.Faxon del. Himely sc.

HICORIA GLABRA, Var. VILLOSA, Sarg.

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